THE AEROPLANE and ASTRONAUTICS

NOVEMBER 18, 1960

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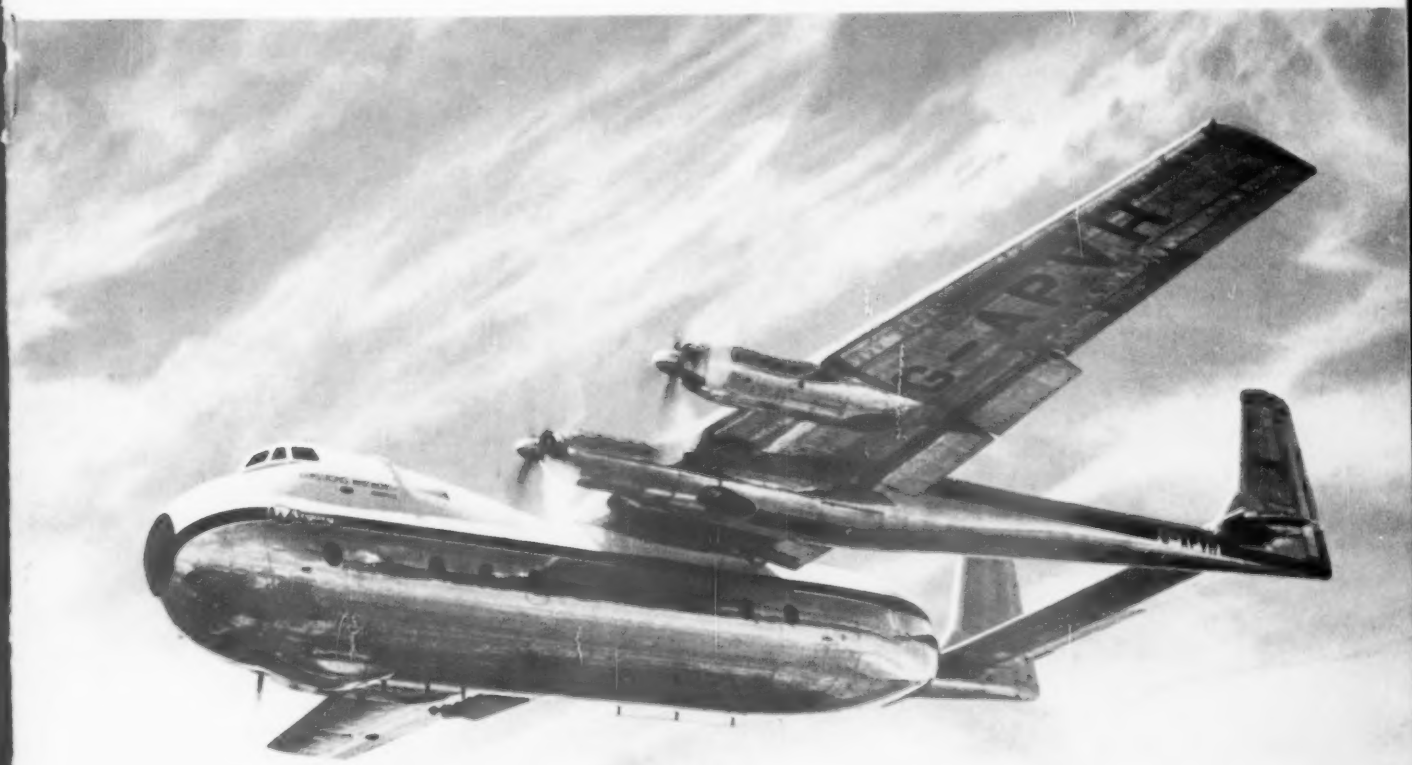

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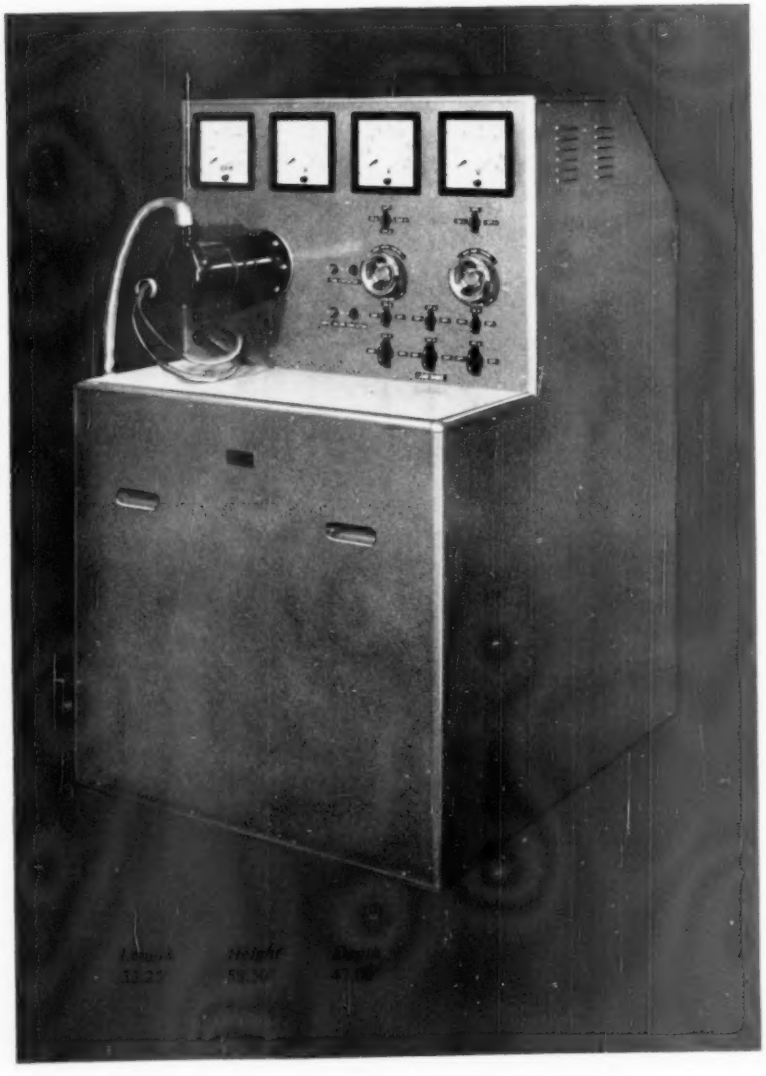

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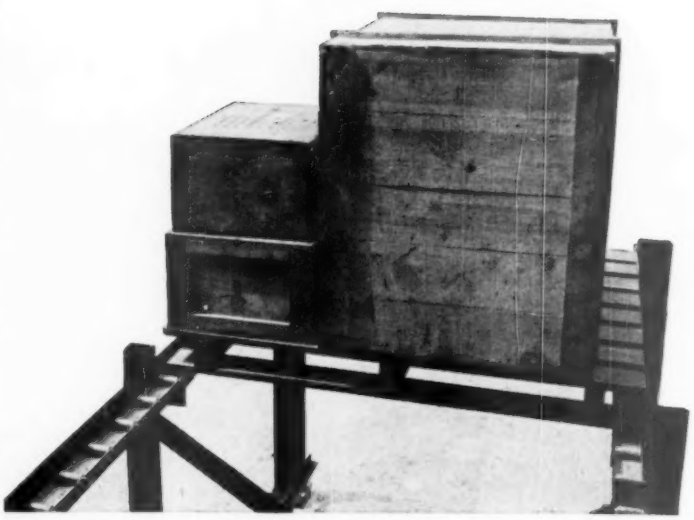

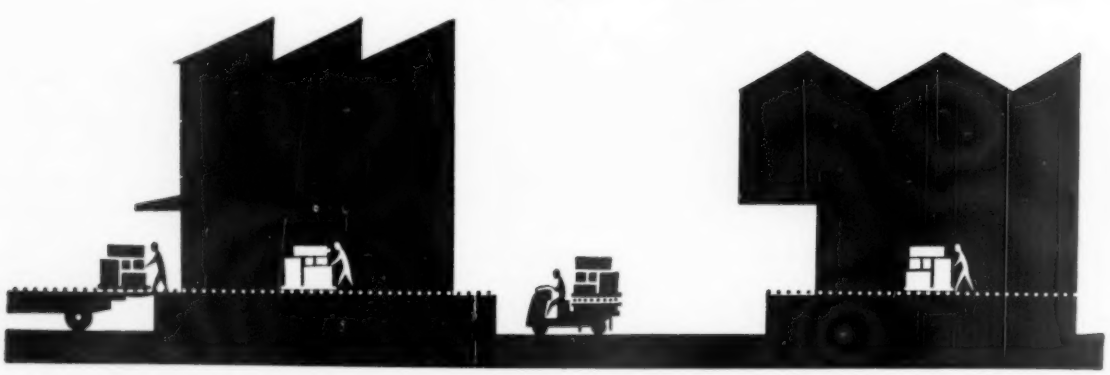

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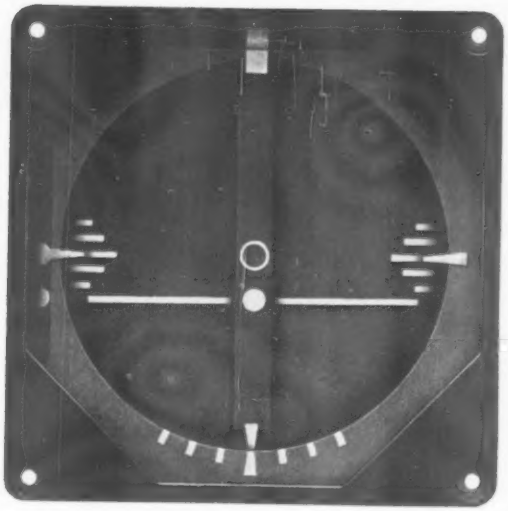

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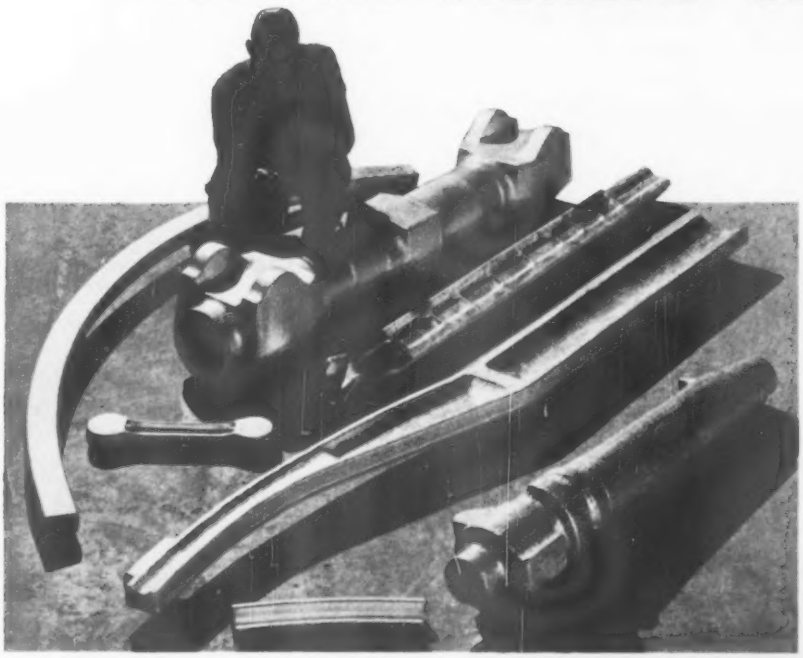

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THE AEROPLANE and ASTRONAUTICS

VOLUME 99 NUMBER 2561 NOVEMBER 18, 1960

Working Together

Last week, in London, the principal speaker at the annual luncheon of the Air League at Mansion House was Sir George Edwards. It was only possible briefly to summarize his speech but in our limited report (Nov. 11) we were able to draw attention to Sir George's quotation from a speech by Vice-president Nixon. This ran:—

"The (U.S.) aircraft industry must have government help in the development process. Nor can we rely on the accidents of military procurement to determine our civilian future in the air. The industry is harassed by the uncertainties of the situation and barely able to help itself, not only because of the staggering cost implications but because of the limitations of policies, good enough at the time, which must be revised and advanced so we may keep ahead in the 1960s. Unquestionably we need a new look at American aviation. It needs to be freed from the traditional limitations of government policy.

"We should establish at the earliest opportunity a special presidential air policy commission to make a re-evaluation of our national aviation policy before the end of 1961. . . .

"We simply cannot allow our national pre-eminence in aviation, both commercial and military, to dissipate; nor can we allow the Communist system to outdo us in this area of such great interest to all the world."

Sir George suggested to his hearers that if American aviation was so important to the United States there could be no doubt of the rôle our own industry should play. Though the idea of an independent commission free from all industrial and governmental influence to perform such a task for our industry is not a new one, Sir George did not specifically recommend it. Nevertheless, mention of such a commission on an important public occasion is bound to set people thinking about the desirability of looking long and deeply into our own situation.

Reports from the Continent of intentions to go ahead with European VTOL supersonic designs amount to a reminder that aeronautical activities cannot be planned for this country within insular concepts. We have to work together with our friends. One thing a commission of inquiry might discover is whether there is yet time to make up the leeway lost in European collaboration.

And working together implies a partnership. It must not be overlooked that the American industry is now linked with manufacturers in Europe. We have such links in the engine field. Are they not capable of extension in the field of airframe construction? If not, our participation in the arming of NATO forces will remain slight.

The Deterrent under the Sea

A shattering reminder of today's speed of weapon development is the announcement that a U.S. nuclear submarine with 16 Polaris solid-fuel missiles, each with a thermonuclear warhead, is operational and on patrol in the Atlantic. Though submarines may be tracked and followed by other submarines, it is difficult to see how ballistic early-warning screens and anti-missile missiles can be used against missiles fired from under the seas.

It is a most sobering thought that whereas life, as we understand it, came out of the sea, the maintenance of peace in the World today depends on the thermonuclear deterrent beneath its waves.

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Matters of Moment

Polaris on Patrol

AN epoch-making event occurred on Nov. 15 when the nuclear submarine "George Washington" left the U.S. naval base at Charleston, South Carolina, with a full complement of 16 Polaris missiles to take up station "somewhere in the Atlantic Ocean." Each of the missiles, far more powerful than the first atomic bombs dropped on Hiroshima and Nagasaki in the last war, has a range of about 1,200 miles. A second Polaris-equipped nuclear submarine, the "Patrick Henry," is to be at sea before the end of the year.

Admiral Burke, the chief of U.S. Naval Operations, described the voyage of the "George Washington" as "one of the most significant operations in the history of warfare." Eventually, it is expected that the U.S. Navy will have 45 of these underwater launching platforms on constant operational patrol—a total of no fewer than 720 thermonuclear missiles dispersed throughout the oceans of the World.

Next year the "George Washington" and her sister submarine are to have a forward supply base in Holy Loch, Scotland.

Closing the R.A.F. Comet Incident

SINCE our report two weeks ago on the incident involving two West German F-86 Sabres and the Transport Command Comet carrying H.M. the Queen, Mr. Julian Amery, Secretary of State for Air, has stated in the House of Commons that the Anglo-German committee of investigation was satisfied that there was no danger of collision. It also fully accepted that the German pilots did not realize that Her Majesty was in the aircraft, and that there was no intended discourtesy.

The committee visited all the headquarters and operational stations concerned. All personnel concerned in the incident were questioned; the Comet and F-86s were inspected; the relevant navigational charts and radar plots were checked.

The committee found that the Comet was flying on its way from Copenhagen to London Airport in accordance with current air traffic procedures. The F-86s were undertaking a battle formation exercise from Oldenburg. They sighted condensation trails at a distance of 10 to 15 miles and closed on them from approximately an ahead position until they recognized what they subsequently described as a "transport or bomber type aircraft." They then pulled away.

The Comet co-pilot could not know that the F-86 pilots had sighted him and acted correctly in reporting an airmiss.

The committee was not able to establish the exact distance by which the F-86s cleared the Comet. It was satisfied that weather conditions were clear and the fighter pilots had the Comet in view the whole time.

At Oldenburg, details of both the outward and return flights of the Comet were brought to the notice of pilots concerned on the day of the outward flight (Oct. 21). They were not subsequently reminded of the return flight on the day of that flight (Oct. 25), nor were they given special instructions.

In answering a question by MR. DE FREITAS (Lab., Lincoln), the Secretary of State said it is possible that if, on that day, special instructions had been given, or a reminder issued, the incident would not have taken place. At the same time, it has been suggested that it might have been better if we had issued separate instructions for each flight, rather than a single NOTAM covering both flights. But it has never been the practice to do this in the past and, Mr. Amery continued, there could be objection to it.

German fighter pilots are not permitted to make practice interceptions on transport aircraft, whether civil or military, and once an aircraft has been recognized as a passenger-carrying type it must not be used as a "target." In clear conditions German pilots are allowed to make interceptions on other combat aircraft but, in general, must not close below 1,000 ft. At Oldenburg, this range restriction is extended to 2,000 ft.

At the time of the incident the Comet captain was not in his seat, although he was in the crew compartment. The two F-86 pilots are understood to have said that they started to break away when they first saw the Comet at a distance of five miles and did not come within 3,000 ft. of it. The Comet co-pilot, on the other hand, said that they were 50 ft. above and 300 ft. away from his aircraft.

Although it had no bearing on the incident, the height of the Comet's return flight was changed from 36,000 ft. to 35,000 ft. without notification to the German Air Force.

The whole business can only be regarded with regret. And not least in the feelings of regret must be that the Royal Air Force got itself involved in an international incident which has terminated in a way which can reflect no credit on those connected with its initiation.

NEW WESTLAND DIRECTORS.—Left, Mr. L. Boddington, who has been appointed technical director (development) of Westland Aircraft, Ltd., and (right) Mr. R. Hafner, who becomes technical director (research).

Pungent Views on Space Research

OPENING a series of joint lectures in which members of the Royal Aeronautical Society and the Institution of Electrical Engineers are to discuss problems and new ideas affecting their common interest in aircraft electrical engineering, LORD CALDECOTE, executive director, guided weapons, of the British Aircraft Corporation, took as his subject "The Future of 'Electrics' and 'Electronics' used in Aircraft and Guided Missiles." A report of his lecture, given on Nov. 11, appears on page 683.

In addition to his main theme, Lord Caldecote had some pertinent remarks to make on the future of Britain in space research. Miniaturization was one of the big outcomes of the development of guided missiles, he said. It was essential for Britain to continue with missile development and take part in space research if we were not to lag behind in many fields of technology.

Asked by MR. G. V. E. THOMPSON, editor of the B.I.S. journal, if by taking part in space research the speaker meant putting up instruments in U.S. rockets or building our own launchers, Lord Caldecote said that, in his opinion, it was not enough for us to go up as passengers; we should develop our own launchers as well.

It was necessary for us to look 50 years ahead. By that time it was quite evident that there would be a great deal going on in space and Britain would then have to be engaged in this activity. Therefore, the sooner the country got on with it the better.

Britain must spend at least £20m. a year on this, Lord Caldecote concluded. There was no alternative. If this meant another shilling on income tax, we must face up to it.

Rolls-Royce Engines for the Buccaneer?

FOR some time it has been an open secret in the industry that an advanced version of the Blackburn Buccaneer naval strike aircraft is to be equipped with a military version of the Rolls-Royce RB.163 turbojet in place of its de Havilland Gyron Juniors. Last week this fact was reported in a daily newspaper. The Admiralty deny that production aircraft now on order—reported to number 50—will be re-engined, but say that a more advanced engine giving greater performance will probably be introduced into the production line at a later date.

The production version of the Gyron Junior, the DGJ.2 Mk. 101, has a take-off thrust of 7,100 lb. The Rolls-Royce RB.163, currently being developed to power the de Havilland Trident airliner, has a take-off rating of 9,850 lb. and a maximum continuous rating of 9,450 lb.; specific fuel consumptions at these thrusts are 0.578 and 0.570 lb./lb./hr. respectively. It has a by-pass ratio of 1.0, a 15.75 : 1 pressure ratio and a mass flow of 202 lb./sec. The engine weighs 2,200 lb. and has an s.f.c. of 0.80 lb./lb./hr. when cruising at 25,000 ft. and 525 kts. in I.S.A. conditions. The first test run of the civil RB.163 is expected before the end of 1960.

A military version of this engine would have many advantages for the Buccaneer; its higher thrust would allow take-off weight

to be increased and thus permit more fuel to be carried. This increased fuel load and the relatively low cruise consumption of military RB.163s should combine to give a considerable increase in the range of the Buccaneer.

Joining the Westland Board

FOLLOWING its recent reorganization into the British aircraft industry's rotary-wing group by the acquisition of Saunders-Roe, Fairey Aviation and the helicopter interests of Bristol Aircraft, Westland Aircraft has announced the appointment to its board of two technical directors, one responsible for development matters and the other for research. Mr. L. Boddington, C.B.E., M.I.Mech.E., F.R.Ae.S., joins the company from the M.o.A. as technical director (development) and Mr. R. Hafner, F.R.Ae.S., becomes technical director (research).

For the past year Mr. Boddington has been Director-General of Aircraft Research and Development (R.A.F.). Born in 1907 he was educated at Lewis School, Pengam, Cardiff Technical College and the University College of South Wales. After training as a pupil engineer with Fraser and Chalmers Engineering Works, he became assistant to Major H. N. Wylie in 1931. He joined the Royal Aircraft Establishment in 1936, becoming head of the catapult section in 1938, superintendent of design offices in 1942, and superintendent of naval aircraft department in 1945.

In 1951 Mr. Boddington was appointed Assistant Director, Research and Development (Naval) at the Ministry of Supply, and was promoted to Director in 1953.

Mr. Hafner, who is chief engineer and special director of Westland's Bristol Helicopter Division, was born in Vienna in 1905 and educated at the technical college there. He produced one of the first helicopter designs in 1927, and in succeeding years was responsible for a number of early rotary-wing designs. During the Second World War, he was engaged on rotary-wing research at the Ministry of Aircraft Production. He joined the Bristol Aeroplane Co. in 1944 as chief designer in charge of helicopter development.

Brough's Premier Lecture

TRADITIONALLY a lecture with an historical emphasis, the Cayley Memorial Lecture—which is the principal event of the year for the Brough Branch of the Royal Aeronautical Society—reached the seventh in the series on Nov. 9 with a paper by Major Oliver Stewart, editor of *Aeronautics*. Choosing as his theme "Forty Years of Aviation Journalism," he did not follow the obvious path of aeronautical reminiscence but elected to lay greater emphasis on the "journalism" than on the "aviation." The result was a paper that, as well as being admirably and entertainingly delivered, is a contribution that provides aspiring aviation writers (technical and otherwise) with some sound first principles and a good deal of most useful advice based on 40 years of practical experience.

As Major Stewart pointed out, the chosen subject was very appropriate to this particular Memorial Lecture because Sir George Cayley had been one of the best aviation writers. He expressed himself succinctly. There was probably no more often quoted phrase than that in which he called the air "an uninterrupted navigable ocean that comes to the threshold of every man's door."

PRESENTATION.—Mr. N. E. Rowe, joint managing director of Blackburn Aircraft (left) presents Maj. Oliver Stewart with a silver salver after his Cayley Memorial Lecture at Hull on Nov. 9.

Cayley's notebooks, he went on, abounded in telling phrases. Pithy comments were to be found on almost every aspect of aviation—including jet deflection and boundary layer control. His greatness was the outcome not only of his ideas but also of his power to express them. This power of arresting expression, said Major Stewart, is a characteristic common to successful inventors and innovators and of great value to engineers or research workers.

From this introduction, he went on to describe in some detail the manner in which "different instruments of publication" have treated aviation during the past 40 years. And this led him to a discussion of the various techniques employed and the conventions and customs that have come to be adopted in the aviation writer's art.

In the short question period which followed, it was quite clear that Major Stewart's paper had been much enjoyed and had provided a great deal of food for thought. A warm vote of thanks to him was proposed by Prof. Brynmor Jones, vice-chancellor of Hull university, and seconded by the deputy editor of THE AEROPLANE AND ASTRONAUTICS. And the formal proceedings were brought to a close by the president of the Brough branch, Mr. N. E. Rowe, joint managing director of Blackburn Aircraft, who followed the generous local custom on these occasions of presenting the distinguished lecturer with a handsome silver salver as a memento of the evening.

FIRST-OFF.—The first of some 200 production Dassault Mirage IIICs ordered for the French Air Force made its initial flight on Oct. 9 at Bordeaux-Merignac, and is now at C.E.V. Bretigny. This is the first photograph of the definitive version of this Mach Two fighter which the R.A.A.F. is expected to order, perhaps with a Rolls-Royce engine.

Matters of Moment . . . .

European VTOL and NATO

MILITARY interest in VTOL aircraft is intensifying, but despite the present British lead in jet-lift technology, it seems possible that this experience may be by-passed on the Continent. This can be deduced from the forthcoming revision, early next year, of the NATO specification for a subsonic strike aircraft, capable of vertical take-off and landing, to demand supersonic performance.

As the latest British VTOL project, the Hawker P.1127, which has already begun hovering trials, is a prototype for a high subsonic cruise strike and reconnaissance fighter for the R.A.F. It uses the Bristol Siddeley jet-lift principle of a single turbofan fitted with swivelling nozzles from the front-fan and turbine effluxes to deflect the available thrust from the vertical to the horizontal axis as required.

The P.1127 development was designed to operate from unprepared sites on low-level sorties below radar cover, but it is now thought that its subsonic speed will make it vulnerable to opposing fighters. NATO interest is apparently in a strike fighter combining the high speed performance of current military aircraft with VTOL capability.

Although a M=2 version of the P.1127 has already been projected, it is now to have considerable opposition from American, French and German designs, which have been under development for some time past. On the other hand, although these will employ more advanced airframes than either of the British VTOL aircraft types which have flown, at least one of them is to use the ultra-lightweight lift powerplants developed by Rolls-Royce.

It has already been recorded that one of the first French VTOL projects will conform fairly closely to the conception of the Short S.C.1, with eight of the same RB.108 8 : 1 thrust/weight ratio engines fitted to the first prototype Mirage III-001 fighter. This pure research project should fly towards the end of next year, and will probably be followed by a similar adaptation of the Mirage IIIA-01 prototype with the 4,400 lb. 16 : 1 thrust/weight ratio RB.162 lift engines, and perhaps an RB.168 propulsion unit.

The first project will probably be subsonic to develop the low-speed autostabilization and control systems, but the next development will almost certainly result in a VTOL M=2 fighter. This will meet the NATO requirements for a second-generation lightweight tactical strike fighter, for which the other contestants will include a Republic/Fokker project, a development of the Fiat G.91 and the Messerschmitt consortium project.

The largest minority shareholder in the Fokker company, Republic Aviation has been studying VTOL problems since 1954, and among many other designs a single-seat M=2.5 fighter-bomber is projected. According to research director Alexander Kartveli, designer of the wartime Thunderbolt, the aircraft would have variable sweep, and six turbojets feeding three lift-producing fans for lifting purposes, and forward thrust for normal propulsion. Association with Fokker would ensure a share in European production in the event of selection by NATO.

Both the Fiat and Messerschmitt projects envisage the use of swivelling engines for lift and propulsion, and so do not overlap in any direct manner with British VTOL experience. The German design, however, is based on the use of a M.A.N.-developed Rolls-Royce RB.153 powerplant. Bell Aerosystems has reportedly been invited to join Messerschmitt, Heinkel and Bölkow in the development of a VTOL fighter for the Luftwaffe and NATO, Bell already having projected the M=2 D-188A V/STOL design.

Despite the unrivalled experience gained by the British industry in transitional problems from vertical to horizontal flight, autostabilization and low-speed control, it seems probable that as in the case of the first-generation NATO fighter and the collective anti-submarine project its rôle will be confined to supplying the powerplants. This, in turn, appears to mean further emphasis on the Rolls conception, since it is difficult to envisage a satisfactory application of swivelling nozzles to supersonic flight, and for multi-engined operation.

A Hover Scooter

AMONG the many ground-effect machines undergoing development in the United States that were described in some detail in THE AEROPLANE AND ASTRONAUTICS for Dec. 11, 1959, one of the smallest was an "air scooter" designed and built by Princeton University's Forrestal Research Center. Circular in shape and having a 26-in. dia. vertically mounted ducted fan to provide the lifting air curtain, the air scooter was designed to be controlled by pilot's body movement.

A development of this device was demonstrated in this country last week and was put through its paces over ground and water. More details will be given in our special VTOL Aircraft and Helicopters issue on Dec. 9 next.

A Chelsea College Occasion

IN his capacity as president of the College of Aeronautical and Automobile Engineering, His Royal Highness, the Duke of Edinburgh, presented the diplomas and awards at the annual prizegiving on Nov. 8. The occasion, attended by a large and distinguished audience, marks an outstanding point in the College's long history of which its supporters and staff have every reason to be proud. As His Royal Highness explained, however, this was the last—as well as the first—time on which he would take part in this particular ceremony, for his term of office was for one year only and had now come to an end. His successor as the College's president was, he announced, to be Rear Admiral Sir Matthew Slattery, chairman of B.O.A.C.

In his address, His Royal Highness said that the transition from student to fully fledged professional was "by far the most profound change of status that anyone has ever to go through." He congratulated the Principal on a very encouraging report of the College activities for the past year, and added that 1959 was a year of particular significance to the College, because it marked the 100th anniversary of the birth of its first president, Lord Wakefield of Hythe.

"This," he went on, "was one of the reasons why I became president of the College this year. I think it would be difficult to overestimate the beneficial influence that Lord Wakefield exerted upon every aspect of the College activities. He was probably the greatest backer of aviation enterprise that this country has ever known. . . ."

Another point made by the president in his address was that although we lived in a technical age and needed a great many trained engineers, this was no reason why students from the College should not expect to find success in administration, in business, in politics, or in anything else.

"In fact, in my opinion, there are a great many enterprises which would be greatly improved and invigorated by the influence of a trained engineer. I would only qualify that by saying that he must show an aptitude for administration and the management of people. . . ."

His Royal Highness concluded by saying that so far only a small part of the World enjoys the benefits of modern engineering, and there is still ample room everywhere for pioneers. Mankind, he said, will always argue about systems of government, religion and justice, but one could be fairly certain that every man could do with modern systems of transport and agriculture. He thought that this may well have been in the mind of the late S. C. Roberts, who founded the College.

The president followed his address by unveiling a memorial to the College's founder whose vision and foresight had been amply rewarded by its success. Many thousands, said His Royal Highness, had cause to be grateful for his work.

Earlier, the Principal, Mr. J. A. C. Williams, M.Sc., A.M.I.Mech.E., A.F.R.Ae.S., A.M.I.Prod.E., A.B.Ps.S., had presented his annual report. This was, he felt, an important one because it showed the first fruits of a revitalized policy which sprang from a careful re-examination of the purpose of the College and of its work, which started about the same time as the Duke of Edinburgh inspected the College in February, 1958.

He outlined the reasons for the College's present policy. "To begin with we carefully studied the many Governmental and other reports which have been issued on technical education since the end of the War, and took careful note of the points they raised, when planning our reappraisal of our methods of training. In addition, we critically examined the validity of some of the assumptions made in these reports in the light of the positions held, and the work now being done by former Diploma students of the College.

"We do realize, however," said Mr. Williams, "that nowadays commercial firms and governments are more certificate minded, and therefore we are now encouraging our students to take more external examinations whilst undergoing training for the College Diploma."

Those receiving aeronautical engineering awards were: R. D. Thomason, the Mollison Challenge Trophy; M. Kreisberger, the Olley Challenge Trophy; P. J. Hawtin, the Nelson Memorial Prize; and G. R. Atiyyah and R. K. Satjadibrata, the Principal's Prize in aeronautical engineering.

City Planning by Balloon

LONDONERS in the City earlier this month were surprised to see two large captive balloons, similar to the barrage balloons used during the War, flying over a vacant site in Ropemaker Street, just off Moorgate. They were novel aids in the planning of British Petroleum's projected skyscraper office block, which is expected to comprise 36 storeys reaching a height of 400 ft. In order to obtain an idea of how such a building would appear in relation to the London skyline, the balloons were flown at this height and photographs taken from various vantage points in the London area. The results are being made available to the various planning authorities concerned.

Contractors for the operation were Aerostills, Ltd., who are specialists in this type of work.

Mr. Harry Ferguson

WE regret to record the death, on Oct. 25, of Mr. Harry Ferguson. Although widely known for the tractors that bear his name, he could also lay claim to some aeronautical distinction. In point of fact he designed and built the first heavier-than-air machine to be flown in Ireland. He flew his small monoplane on Dec. 31, 1909, and the late C. G. Grey in reminding us of this event in 1948 (when Mr. Ferguson's name was very much in the news as the result of his claim of £62,750,000 against the Ford Motor Co.) said that the craft was very like a small Antoinette. "The engine," he said, "was a J.A.P. out of which Harry coaxed many added h.p."

Air Marshal S. Mukerjee

IT is with great regret that we record the death, in Tokyo on Nov. 9, of Air Marshal Subroto Mukerjee, Chief of Air Staff of the Indian Air Force. The Air Marshal was the first officer of Indian nationality to take command of the I.A.F., of which he became C.-in-C. in April, 1954. Under his guidance, the Indian Air Force has grown into a large and very well-equipped organization, operating a large number of British aircraft, including Hunters, Canberras and Gnats.

Subroto Mukerjee was very well known in this country and maintained the close ties with the R.A.F. which started with his attendance at the Royal Air Force College, Cranwell, in 1930. After receiving his commission in 1932, he became one of the first officers of the Indian Air Force on its formation on Apr. 1, 1933. He joined No. 1 Squadron, I.A.F., and operated alongside the Royal Air Force from Karachi, Lahore, Ambala, Peshawar, Kohat, Risalpur and Quetta with Westland Wapiti b.planes. He also took part in operations against tribesmen on the North-West Frontier, flying from advanced airfields at Miranshah and elsewhere.

During World War II, he commanded the R.A.F. Station at Kohat, from 1943-44, being the first Indian to do so, and was mentioned in despatches for distinguished services. After the granting of self-government, in 1947, he was appointed Deputy Commander of the I.A.F., and succeeded Air Marshal G. E. Gibbs, R.A.F., as C.-in-C. in 1954. His death was all the more tragic in that it resulted from accidental suffocation during a meal while on an official visit to Japan.

Anniversary Award

ON Sept. 28 Bruno Jablonsky, managing director of Jablo Plastics Industries, Ltd., was advised of his election to a fellowship of the Royal Aeronautical Society.

We do not know whether or not the Council of the R.Ae.S. were aware of the fact, but the date had a special significance, for on Sept. 28, 1910, Bruno Jablonsky got his original brevet as one of the first pupils of the flying school which Orville Wright set up at Berlin/Adlersdorf in 1909. It was extended on May 15, 1911, to cover monoplanes as well. It is an interesting historical fact that the machine on which the young Jablonsky qualified was the first Etrich Taube to fly in Germany.

In 1913 Mr. Jablonsky brought the Garuda propeller to London for the Olympia Aero Show. His interest in airscrews continued and as long ago as Nov. 27, 1935, THE AEROPLANE contained a description of the Jablonsky controllable-pitch airscrew. Of recent years Mr. Jablonsky has become extremely well known for his work on plastic materials. He received two awards for propeller development and supply during World War II and in connection with Mosquito construction.

Sir George Edwards Scans the Industry's Future

ON two recent occasions Sir George Edwards has delivered speeches which have impressed his hearers by their earnestness and honesty of purpose. The industry itself must welcome the proclaiming of such basic truths as the profound importance to the whole British economy of a sound and a balanced aircraft industry, not only for defence and all kinds of military transport but also because new engineering techniques and materials spring from aeronautical endeavours.

Basically, the same themes ran through both speeches. On the military side it is now clear that manned aircraft will continue to be needed for many rôles. In some of these, manned aircraft will be supported by missiles. On the civil side, as regards the supersonic aircraft, we, and particularly the Americans, must make up our own minds and not be induced to change our thinking in order to outdo the Russians. Today the British aircraft industry has the brains and ability to play a leading part in the future before it, but it must have stability and a prerequisite of stability is a firm Government policy.

Sir George began his speech with a warm welcome to Mr. Peter Masefield's new venture in the field of light aircraft manufacture. At an early stage in his speech he emphasised the growing factor which would dominate all future plans in this country: the importance of making a decision in time. Later he was to refer to the disastrous waste of effort in cutting off a development on which much effort had been lavished.

This country, with the Americans, is endeavouring to impose such a threat on the Soviet Union that the latter will not risk initiating an attack. Imposition of this threat must be in as many different ways as are technically and economically possible. The largest part of the deterrent effort to be made by the West is vested in the United States, but Great Britain has a powerful independent contribution to make. Bearing in mind responsibilities to the Commonwealth and Colonies, there are three jobs to be done: the deterrent; obligations to the Commonwealth members; and responsibilities in the event of restricted operations.

Sir George made it quite clear that in his view the marriage of the air-launched missile to the more or less conventional bomber able to operate from small airfields met our need of mobility and flexibility and came within the confines of a limited budget. The purchase of Skybolt and its carriage by our V-bombers should extend their "credibility" until at least the early "'seventies." He thought that if Skybolt became ineffective its replacement by a more advanced design was feasible.

He observed that a by-product of our deterrent policy could be the imposition of a defence burden which Russia might find economically unbearable and so force her to adopt a policy more likely to lead to peaceable relations with the West.

The land-based missile in Western Europe savoured far too much of the Maginot Line complex.

Conventional weapons must be available. The concept of the manned aircraft with a large assortment of weapons and equipment to meet varying situations gave defence planners room for manœuvre. He concluded that there would be a continuing need for manned aircraft in almost all rôles and that there will be a few basic types upon which many changes will be run. Let it not be forgotten that they still have to be built at the right time, he emphasized.

Regrouping of the industry was inevitable and a proper step. It has been strengthened by the resultant flexibility and mobilisation of resources. In a year or two the Americans will have to follow suit.

It was not until the subject of the Air League's recommendation of a Mach=3 airliner with VTOL capability came up that there was any reference to vertical take-off in Sir George's speech. He made the point that nobody yet knows how to make a Mach=3 airliner, let alone one with vertical take-off. "If we tried very hard we might manage a usable Mach 2 airliner by 1972 using the runways made necessary by the American jets."

Sir George in a statesmanlike survey of this nature had, perforce, to brush in his picture in broad strokes. But outside the picture that was so effectively placed before his hearers there remains the future of VTOL capability and also the development of vehicles for operation beyond our atmosphere. The first has received some consideration from the Air League. The second remains something that is yet hardly a gleam in our planners' eyes.

Yet both are fields in which the rate of technical progress is rapid. If we have scarcely crossed the threshold of the second, we have done much in the first. We must hope that an opportunity will arise for Sir George to survey it.

U.S.N. Anti-submarine Plans

WITH Russia possessing an estimated 450 submarines, it is not surprising that the U.S. Navy considers that anti-submarine warfare is one of its most important rôles. It is not known how many—if any—of the Russian submarines are nuclear-powered, but the sheer number of even conventional types offers a considerable threat and planning must assume that nuclear types will be used in future. During a recent visit to the U.S., America's anti-submarine plans were discussed.

In event of an all-out War, the U.S. Navy aims to destroy as many submarines as possible before they get to sea. Missile and carrier-borne aircraft attacks will be made on their home bases. The second aim is to bottle them in and to destroy them in the narrow seas through which they must pass before they can emerge into the wide oceans.

Use will be made of fixed-array listening systems, in effect automatic detection posts, which can be put on any coast or island. Shallow- and deep-water systems are possible, and they can even be laid under the polar ice, which is likely to be one of the major battlefields in any future war.

With such systems, passive listening can be effective up to 50 miles and, in very good conditions, up to 100 miles. But beyond the coasts it is considered more economic to use nuclear submarines as listening posts.

In such wide ocean channels as the Greenland-Iceland-Faroes gaps, hunter/killer nuclear submarines will be used both to detect and to destroy enemy submarines. They will be supplemented by land- and carrier-based aircraft and helicopters, and destroyers.

Finally, it is planned to attack the enemy in his target area. HUK, or hunter-killer, groups based on ASW carriers play an important part. Seven groups are now deployed, four in the Pacific and three in the Atlantic. Each is built up around an Essex-class carrier which has been modified for anti-submarine warfare, and is equipped with both helicopters and fixed-wing aircraft. In addition, a typical group has eight destroyers and may also operate in conjunction with land-based aircraft and anti-submarine submarines.

Typical land-based aircraft used at present are the P2V Neptune and P5M Marlin. In future the P3V, a naval version of the Lockheed Electra, will be used.

Each carrier is equipped with 40 Grumman S2F Trackers and 16 Sikorsky HSS-1N helicopters, as well as with Douglas AD5-Ws for detection-radar surveillance around the group, two Vertol HUPs for plane-guard duty and a Grumman TF, transport version of S2F, for liaison.

The S2Fs are equipped with detection radar; MAD (magnetic anomaly detection) gear, which pinpoints the position of a submarine, but only when the aircraft flies directly over it; sonobuoys; ECM equipment; depth-charges, both conventional and nuclear; homing torpedoes; and unguided air-to-surface rockets. The effective range of a nuclear depth-charge is measured in hundreds of yards rather than in feet as for conventional ones.

The Sikorsky HSS-1Ns are equipped for night and limited instrument conditions. Their maximum speed is 125 knots and they have a combat radius of 75 naut. miles, allowing for an on-station hovering time of 90 min.

Each helicopter carries "dunking" sonar, which is lowered into the water while the helicopter is hovering, to detect and track submerged submarines. A typical detection range with this sonar is 2,500 yd., although in ideal conditions it can be as much as 5,000 to 6,000 yd.; in bad conditions, however, such as when the water is muddy, the range can be 500 yd. only.

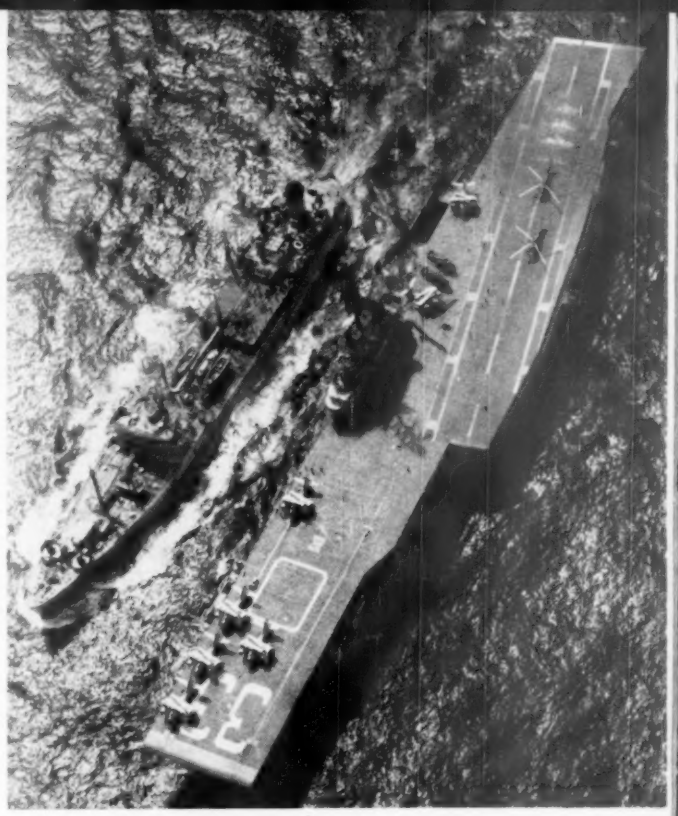
Destroyers are equipped with radar, sonar and ECM gear. Their sonar is a considerable improvement on that of the Wartime years, and can track submarines up to ranges between five and ten miles. The extent of this equipment is suggested by a remark made by one U.S.N. officer: "Half the bottom of the ship is a sonar transmitter." Destroyer armament includes depth-charges, mortar-type "hedgehog" projectors and anti-submarine torpedoes.

Nuclear submarines can operate submerged at well above 30 knots, and thus out-run destroyers easily. This has led to the development of rocket weapons such as Alfa and Asroc. Nuclear killer submarines rely on passive listening and long-range sonar to detect other submarines and on homing torpedoes to destroy them.

The HUK group acts as a team. The HSS-1Ns operate in line abreast ahead of the destroyer screen, hovering and dunking their sonar, and moving on if they receive no contact.

If an S2F receives a radar contact, it drops a sonobuoy and calls up the helicopters. They use the most appropriate search pattern to track down the contact and, when they detect the submarine they surround it and call up S2Fs. These go into a "MAD trapping circle" to identify the contact positively and to pinpoint its position; they then attack it with nuclear or conventional depth-charges or homing torpedoes.

Accurate detection of a submarine's position is still the major problem. It is made more difficult by the revolutionary advance in submerged speed which nuclear power has given the submarine, as well as the ability of such submarines to remain under water indefinitely. Technical advances are needed desperately; as a U.S. admiral remarked, "If we had something comparable to radar under the water, it would be a fine breakthrough."—J.R.C.



ASW CARRIER—The U.S.S. "Kearsarge" is typical of the U.S. Essex-class carriers which form the basis of anti-submarine hunter-killer groups.

DISCOVERER RECOVERY.—On Nov. 14 the U.S.A.F. successfully recovered a 300-lb. instrument capsule from its Discoverer 17 satellite, using the air-snatch technique shown here. The parachute is snared by a wire between two booms. The capsule was ejected on the 31st orbital pass, and came down over the Pacific near Hawaii. It was the second successful air-to-air recovery of a Discoverer capsule.

Commercial Aviation Affairs

ATLANTIC CHARTERS. — Flying Tiger Line is planning next year to offer its full fleet of 10 L-1049s in a series of low-fare North Atlantic group charters. Return fares between London/Paris and New York may be as low as £58 and 50 lb. of free baggage will be allowed.

STANDARD BAGGAGE. — Since Nov. 13 B.O.A.C. has been using standard passenger baggage weights for all aircraft except the 707. The weights are 13 kg. (28.6 lb.) for hold baggage and 4 kg. (8.8 lb.) for cabin baggage. Although baggage must still be weighed, so that any excess can be charged, the system will simplify and speed-up procedures.

NOISE LAWSUIT. — The expected court test of the P.N.Y.A.'s noise rules for Idlewild (see our issue of Nov. 4, p. 607) may not now be necessary. Delta Air Lines, alleged to have been persistently disregarding the rules, has been granted a request for an extension of time (to Dec. 31) for answering the complaint and for demonstrating compliance in future.

ETHIOPIAN EXTENSION. — On Nov. 8 Ethiopian Airlines started trans-Africa services with DC-6Bs to Accra, Ghana and Robertsfield, Liberia, via Khartoum. Ethiopian has two Boeing 720Bs on order for delivery in December, 1961, and these will be put on the European and trans-Africa services.

SEPTEMBER TRAFFIC.—Estimates for U.K. scheduled and inclusive tour traffic for September show, at 56 million short ton-miles, an increase of 19% by comparison with September, 1959. The average load factor fell from 67% to 65%.

MORE ALITALIA VISCOUNTS?—Alitalia is planning to buy five Viscount 745s from Capital Airlines, Washington, to replace its Convairs, which are to be sold to the Italian Air Force.

CARAVELLE ORDER.—Air France has ordered six more Caravelles, bringing its eventual fleet total to 33 of the type. Delivery will be late 1961 and the order brings the number of Caravelles sold to 101.

ROYAL WHIRLWIND. A British United Airways' Westland Whirlwind (G-AOZK) carried H.R.H. Princess Alexandra on three occasions during her tour of Nigeria. This is believed to be the first time on which a member of the Royal family has flown in a civil helicopter.

WASHINGTON TRAFFIC RULES. —From Nov. 29 special F.A.A. operating rules for safety and noise abatement will apply to the Washington National Airport traffic area. During the 1960 fiscal year Washington was the second busiest airport in the U.S.A. A total of 306,639 movements were handled—by comparison with Chicago Midway's 386,126.

GHANA'S SECOND BRITANNIA. —On Nov. 8 Ghana Airways' second Britannia 309 (named "Osagyefo" or "Wise One") was formally handed over at Filton to H. E. Mr. Krobo Edusei, Ghana's Minister of Transport and Communications, after he, Mr. James Mercer, chairman of Ghana Airways, and other Ghanaian officials had flown in it from London Airport on the previous day. A total of 82 production Britannias have been built and sold at a total value, with spares, of about £100 million.

BACK TO LYDD.—Because of pressure on existing facilities at Manston, Silver City will, after Dec. 1, 1960, operate its Ostend passenger and vehicle-ferry service from Ferryfield, Lydd. The base for this service was moved to Manston last April.

COMET TROUBLE.—B.E.A.'s fleet of seven Comet 4Bs was temporarily withdrawn from service for the second time on Nov. 7 following nosewheel-axle failure while lining up for take-off at Zurich. Olympic Airways three 4Bs were also grounded. B.E.A.'s fleet had been withdrawn for the same reason on Oct. 29. New axles were fitted to some aircraft after the second failure and modifications are in train.

LECTURE REMINDER.—At 18.00 hrs. tonight, Nov. 18, Mr. J. R. D. Tata chairman of Air India International, will deliver the 16th R.Ae.S. British Commonwealth Lecture at the Institution of Mechanical Engineers. The subject is "The Story of Indian Air Transport" (see last week's issue, p. 628).

FATAL ACCIDENT.—Area, Aerovias Ecuatorianas' Fairchild F-27 crashed into a mountain while approaching, and about 15 miles from, Quito Airport on Nov. 7. All on board, 37 passengers and crew, were killed.

News About People

SILVER CITY BOARD CHANGES.—Mr. C. Martin Fox has been appointed a joint managing director of Silver City Airways and Mr. Ray V. Baker, general manager, Northern Division, has become a director.

LOCKHEED APPOINTMENT.—Mr. C. A. Chapman has been appointed vice-president of sales for Lockheed Aircraft International. Born in London, he was with Handley Page until he joined Lockheed in 1951.

HAWKER SIDDELEY.—Mr. A. J. Wallis has relinquished his appointment of group public relations officer to the Hawker Siddeley Group. His successor has not yet been named.

DOWN UNDER.—Earlier this month the New Zealand Division of the R.Ae.S. held a dinner to commemorate 25 years of commercial aviation progress. Left to right, Mr. B. Rae, Air Secretary; Mr. D. Patterson, President, N.Z. Division; Sir Leonard Isitt, chairman TEAL and NZNAC; Gp. Capt. J. Pelley-Fry, U.K. Air Adviser; and Mr. F. Reeves, general manager TEAL.

EKCO MANAGERS.—Mr. P. I. Stride has become manager of the Aviation Division of Ekco Electronics at Southend. Mr. P. J. Harvey has been appointed manager of the company's Nucleonics and Industrial Division.

SWEDISH NEWS.—SAAB has formed a U.K. subsidiary—SAAB (Gt. Britain), Ltd.—to handle its interests in this country. The directors are Mr. T. Holm (chairman), Mr. A. R. Moore (managing) and Mr. G. R. Alford.

SWISSAIR APPOINTMENT. — Mr. Peter-Felix Dueblin has been appointed station manager for Swissair at L.A.P. in succession to Mr. W. Unholz who has become station controller at Zurich Airport after 14 years as airport representative for London.

BROOKE TOOL APPOINTMENTS. —Mr. H. E. Evans, Mr. E. W. Hancock and Mr. K. G. Walton have become directors of Brooke Tool Automation, Ltd. Mr. Evans has also been appointed production manager and Mr. Walton has become general manager.

MR. M. A. CHAMPION.—We regret to record the death of Mr. M. A. Champion, works director of Rotax, on Nov. 12. He was chief inspector before becoming works director, and had just completed 25 years' service with the company. He was due to retire in December.

More News Items on page 694

Air Transport

The Essential Institution

NO vigorous statements of new policy characterized either of the two speeches at the annual dinner of the British Independent Air Transport Association on Nov. 9. None could have been expected, though year by year the more optimistic of the guests and members hope vaguely for new Ministerial light to shine into some of the darker corners of the independent airline business. These optimists are never satisfied simply to enjoy the unique opportunities for uninhibited gossip during a gathering which has now become an essential annual institution in British air transport.

The nearest approach to such statements was made when the subject of airport economics was raised. Mr. C. J. Stevens (B.K.S.), president of the Association, commented that the announcement of increases in landing fees had come as a severe blow to the independents. He said that airport finances were like those of airlines in that high utilizations were necessary and suggested that there should be more co-operation in the use of off-peak hours with a lower scale of fees to encourage the greater use of these slack periods, particularly by freight aircraft.

Mr. Peter Thorneycroft, Minister of Aviation, insisted that air transport must be able to carry its own terminal charges and that airlines must pay for the facilities provided. Airports were not, he said, charitable institutions, nor were they part of a welfare state; the Ministry, like the airlines, was in the business to make ends meet. He hinted at the possibility that the major airports, at least, might eventually be operated by an independent corporation.

Mr. Stevens announced that the president-elect to follow his successor, Mr. Clive Hunting (B.U.A.), would be Mr. Harold Bamberg (Cunard Eagle).

B.E.A's Half-Year

THE B.E.A. traffic figures for September, in the table below, demonstrated a 20% improvement in ton-miles sold by comparison with the same month of 1959 and preliminary figures show that the trend is likely to have been maintained in October.

During the first half of the current financial year the Corporation carried 21% more total traffic than in the corresponding period for 1959.

	September, 1960	September, 1959	Variation
Capacity ton-miles offered	25,032,000	20,132,000	+24.3%
Load ton-miles sold	18,057,000	15,009,000	+20.3%
Revenue load factor	72.1%	74.5%	− 3.2%
Passengers carried	458,977	388,933	+18.0%
Passenger-miles flown	166,525,000	140,286,000	+18.7%
Passenger load factor	74.9%	78.0%	− 4.0%
Freight ton-miles	1,470,800	1,289,800	+14.0%
Mail ton-miles	332,400	307,800	+ 8.0%
Aircraft miles flown	4,218,000	3,952,900	+ 6.7%
Revenue hours flown	20,450	20,453	—

Reducing the Penalties

A NUMBER of papers at last month's S.A.E. National Aeronautic Meeting in Los Angeles (Oct. 10-14) were of direct interest to the airline industry. Two, in particular—describing the use of computer techniques in flight planning* and stressing the penalties imposed on turbojet aircraft when these are not flown to optimum procedures†—were of special importance in relation to the A.T.C. environment.

The idea of using a computer for flight planning is not new. Some time ago, a minimum-time track computer was developed in Holland and became known as the K.L.M. Computer and many other means have been evolved to cut down the time required to produce accurate plans. But the needs have been emphasized by the appearance of the turbojets with their more critical operating characteristics and gross weight/payload/fuel ratios.

For a given track to be flown, the determination of the flight profile is a complex problem, one which must take into account the meteorological parameters and the philosophy of operation. These elements are not fixed at any one point and include en route winds, temperatures, the continually changing weight of the aircraft, as well as payload and reserve fuel requirements established at the departure point. When the choice of track is thrown into the picture, the solution of the optimum flight-planning problem is complicated even further.

Since Sept. 1, 1959, United Air Lines has been employing a general-purpose Bendix G-15D digital computer for the solution of this problem. Obviously, accurate and up-to-the-minute forecasts of winds and temperatures are primary requirements for the solution of flight-plan problems. The end result—however accurately and quickly computed—can be no better than the forecasts that have been fed in.

The computer must be capable of defining accurately the performance limitations of the particular aircraft involved as well as having available the necessary logic to select the best available altitude within the framework of A.T.C. limitations. Data input to the computer consists of all the day-by-day variables. These include operational information which is obtained from the responsible dispatcher and forecast meteorological data. Actual input to the machine is accomplished by a clerk who physically types the information directly into the memory unit. When the "compute" signal is given the input data is examined for obvious errors and the computer then calls in, from an auxiliary storage unit, the remainder of the information necessary to complete the plan. This consists of the route data and the performance characteristics of the particular type of aircraft involved. The former includes headings, mileages and altitude restrictions, and the latter is in the form of coefficients which may be used to describe the limitations and performance of the aircraft.

When the computer has completed the simulation, instantaneous values of temperature, true air speed, ground speed, and gross weight, as well as segment totals of distance, time, and fuel burn-out are typed, with heading information and cumulative totals. These totals include a comparative number that may be used to reflect the operating costs of various flight plans.

An illustration of the possible savings on a United Air Lines' transcontinental flight when this is operated to an optimum flight plan, as opposed to a constant-altitude philosophy, was given in the paper.

A non-stop DC-8 flight, planned from Los Angeles to New York at a constant altitude of 29,000 ft., would have taken 4 hr. 40 min., would have required 69,000 lb. of kerosene and would have taken off at a gross weight of 231,000 lb. The optimum economy plan for this trip, with the same payload, but stepping once to an altitude of 33,000 ft., required one additional minute of flight time, but fuel burn-out was 4,400 lb. less and the take-off gross weight was lower. Operating expense savings for the optimum as compared to the constant-altitude operation came to approximately $95. This, in itself, does not look like a large cost reduction figure. However, when one multiplies this by the number of long-range trips projected by U.A.L. for 1960 and 1961, the total theoretical savings run to more than $1,000,000.

The importance of optimum flight planning was emphasized in the second paper, which spelt out some of the losses in money, payload and time caused by deviations from this optimum. Such losses start on the ground and the author cited a case in which, as a passenger, he had waited in a line of 17 turbojets for 32 min. before starting the take-off roll. There were more than a dozen aircraft still waiting and "the fuel used in this episode was sufficient for a transatlantic flight by any of the long-range jets."

Departure control, too, involves heavy losses. A jet aircraft leaving Los Angeles for New York will often be involved in a procedure which adds 100 miles to the route distance, which increases the journey time by 15 min. and costs 3,500 lb. in fuel.

For traffic safety reasons, constant-altitude operation is the order of the day, with only the hope of getting one, or perhaps two, intermediate altitude assignments. A.T.C. requires 4,000 ft. of vertical separation between flights travelling in the same direction on the same course. During a 2,000-naut.-mile flight with a DC-8, the use of an altitude of 30,000 ft. instead of 25,000 ft. saves 9,600 lb. of fuel and $220 in direct operating cost with essentially the same trip time.

* "Electronic Computer for Optimum Flight Plan Determination," by M. E. Balzer, supervisor, weather centre, United Air Lines.

† "The Penalties of Non-optimum Flight Operations of Jet Aircraft," by A. C. Butterworth, director, market research and sales engineering, Douglas Aircraft Company.

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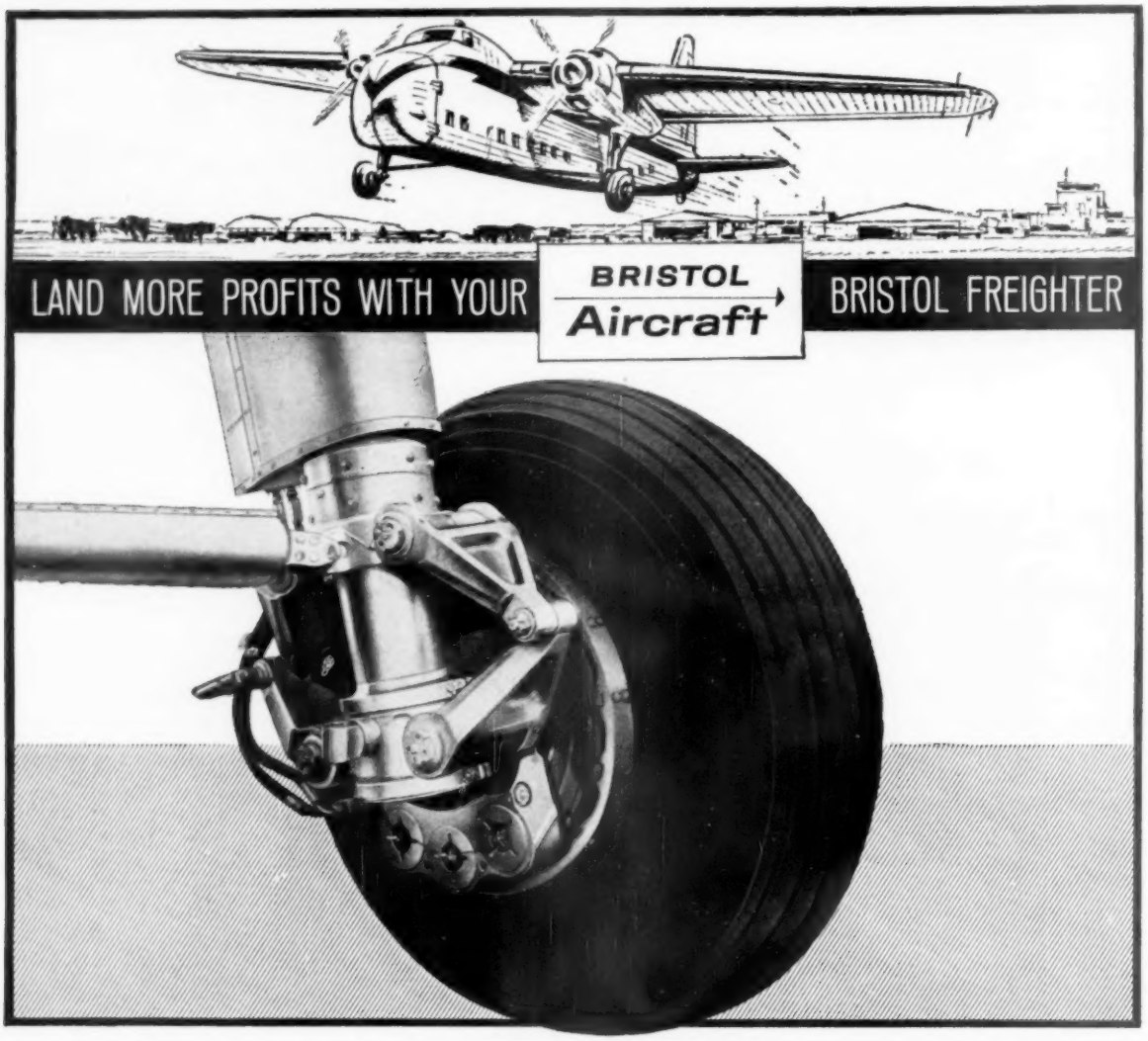

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Air Transport . . . .

MAIDEN FLIGHT.—Aerlinte Eireann's Boeing 707-048 "St. Patrick" on its first flight over Renton. The transport is expected in Dublin to-day, and will go into service on the company's transatlantic routes to Boston and New York on Dec. 14.

Background to a Fare Rationalization

AS we reported in last week's issue (p. 629), Trans-Canada Air Lines and Canadian Pacific Airlines will, on Jan. 2, 1961, introduce a new fare structure based on rational cost-curve principles following a 12-month study. In general, there will be fare reductions on non-stop services of more than 600 miles, little change over distances of 400-600 miles, and increases over distances up to 400 miles. In a concerted effort to tap the mass air-travel market, economy fares are being extended to all points in the Dominion.

Our Canadian correspondent writes:

The new rates are based on a cost study by a University of Western Ontario economist, who developed a series of cost-distance functions. Costs per mile were shown to vary inversely with distance flown, and to rise exponentially for short distances. Mr. W. Gordon Wood, T.C.A. vice-president, sales, believes these functions are the first ever to be developed by an airline. They help to eliminate the anomalies in the fare structure, which has grown like Topsy.

For distances up to about 300 miles, present-day aircraft can offer no significant saving (in city-to-city times) over surface transport and the increased fares on short stages would drive some passengers to this competition, although, Mr. Wood says, even these new fares did not cover costs. Canadian carriers do not receive a subsidy, although American local-service airlines received a toothsome $52,000,000 last year from a benevolent Government. Until costs can be further reduced, Mr. Wood sees no application for an air-bus service of the type provided by Allegheny and Eastern. Operating without reservations was an objective, but, like an economical STOL aircraft, that was just a glimmer in the eye.

T.C.A.'s experience on international routes showed that the mass market will move in the lowest-fare class. Even businessmen on expense accounts often travel economy. This experience influenced the two Canadian airlines to make economy the standard class, and to extend such service to every point. Tourist traffic constitutes 35% of present domestic traffic, but the new economy class is expected to comprise 60%. This will give the Canadian lines the highest percentage of economy seats of any North American carriers.

Mr. Wood estimated that the new fares will reduce the number of passengers travelling by less than 1%, slightly reduce the return per passenger-mile, but increase total revenue. At present 60% of traffic is short haul, a figure that is likely to decrease with the new rates.

To smooth out fluctuations in demand, 23- and 24-day round-trip excursions fares are being introduced. These will be 25% lower than economy fares, which are themselves reduced. The excursion fares will be available between Jne. 1 and Sept. 30, and at non-peak times during the week. It is these fares which are thought to be the lowest in the World. T.C.A. expects other major carriers, in the U.S.A. especially, to study and then copy these tariffs. The Canadian fare revisions come at a time when U.S. carriers have just received their fourth fare increase in three years. The last major fare change in Canada was the somewhat tardy introduction of tourist fares as long ago as 1958.

Coincident with the fare changes, round-trip and other discounts are being eliminated, baggage allowances will be increased to overseas standards, and excess baggage charges will be reduced. There will be no charges for en-route stop-overs or for turbojets

Mr. Wood said that the reduced fares and increased baggage allowances have been made possible by the introduction of an all-turbine fleet (incidentally all Rolls-Royce-powered) in 1961. The arrival of the Vanguards, beginning soon, would enable the North Stars and Super Constellations to be retired. Many of the Viscounts will be converted from 44 to 54 seats, although hot meals and two cabin attendants would be standard on economy flights. Mr. Wood expected that the Viscount would continue in service for years, rather like the DC-3, with a similarly good market developing for used aircraft in the future.

Meanwhile, T.C.A. was hoping to dispose of its seven-stop milk run between Calgary (Alta.) and Winnipeg (Man.) because runways at the wartime training fields were too short for the Viscount. The airline's only other DC-3s, on the 40-mile, over-water, Vancouver-Victoria run, would be replaced by Viscounts for the sake of uniformity if not economy. The present return fare of $10 might more logically be $40, if costs were considered.—NEIL A. MACDOUGALL.

WEST INDIES TERMINAL.—Now operating on a 24-hour basis, Barbados' Seawell International Airport handled 3,476 movements during 1959 and 36,992 landing passengers passed through this new terminal. The single 7,000-ft. runway is due to be extended and it is expected that the airport will be served next year by long-haul turbo-jets in addition to T.C.A.'s Vanguards.

The Fighting Services

Eight More Squadron Standards

HER MAJESTY THE QUEEN has approved the award of Standards to Nos. 21, 37, 53, 66, 72, 73, 80 and 83 Squadrons in recognition of their completion of 25 or more years' service.

No. 21 Squadron, now based at R.A.F. Eastleigh, Kenya, is equipped with Twin Pioneers, and co-operates with Army units of the Strategic Reserve in a light transport rôle. No. 37 Squadron operated in the 1939-45 War against targets in Europe, Cyrenaica, Tripolitania, Crete and the Dodecanese Islands. It is now a maritime reconnaissance squadron, equipped with Shackletons and based at Khormaksar, Aden.

Equipped with Beverleys, No. 53 Squadron is based at Abingdon. An army co-operation squadron when formed in 1915, it helped to cover the Dunkirk evacuation, and after taking part in the Battle of Britain, turned to convoy escort and anti-submarine duties. Formed in 1916, No. 66 Squadron served in both World Wars. In 1959 it won the Dacre Trophy as the top gunnery squadron of Fighter Command. Equipped with Hunters it was disbanded at R.A.F. Acklington in September of this year.

No. 72 Squadron is at present stationed at R.A.F. Leconfield and equipped with Javelins. No. 73 Squadron served in France in both World Wars and is at present operating Canberras from R.A.F. Akrotiri, Cyprus.

Formed in 1918, No. 80 Squadron, now based at R.A.F. Bruggen, and equipped with Canberras, was the first R.A.F. squadron to enter Greece. It subsequently fought in the Battle of Athens, and operated in France and Germany after D-Day. No. 83 Squadron, based at Scampton, was the first Bomber Command squadron to be equipped with Vulcans. Formed in 1917, it fought on the Western Front in the First World War, and in the second became a part of the Pathfinder Force.

The End of "Firedog"

LAST month's handing over of the R.A.F. station at Kuala Lumpur to the Royal Malayan Air Force (see THE AEROPLANE AND ASTRONAUTICS for Nov. 4), marked the official end of the 12-year-old "Firedog" campaign in Malaya. Since it started in 1948, Commonwealth squadrons operating with the Far East Air Force have flown some 36 different types of aircraft in support of the ground forces.

Among the first units to re-enter Kuala Lumpur with the Task Force in July, 1948, were No. 60 Squadron, now at Tengah, Singapore; No. 110 Squadron, now operating helicopters at R.A.A.F. Butterworth; and No. 28 Squadron, at present based at Hong Kong. No. 45 Squadron, now also at Tengah, was posted there the following month.

No. 60 Squadron flew Spitfires, Harvards, Vampires and Venoms, and between 1948-58 logged approximately 5,570 "Firedog" sorties. During 1948-49, No. 28 Squadron operated Spitfires and Harvards, logging 650 sorties. No. 45 Squadron (1948-59) flew over 5,500 sorties with Beaufighters, Harvards, Brigands, Buckmasters, Mosquitos, Hornets, Vampires, Venoms and Canberras.

In addition to these squadrons which were stationed at Kuala Lumpur for varying periods of the emergency, many other units used the base for "Firedog" sorties. No. 33 Squadron flew 6,150 sorties with Harvards, Hornets and Mosquitos between 1949-55, and another fighter-bomber squadron—No. 84—operating Brigands, Buckmasters and Harvards, logged 2,685 sorties in three years. Equipped with Pioneers, Dakotas, Austers and four other types, No. 267 Squadron flew some 30,500 hrs. in 35,000 sorties on jungle support work.

Nos. 155 and 194 Squadrons, and their successor—No. 110—flew Sycamores, Dragonflys and Whirlwinds, and together with the 1950-51 Dragonfly Casualty Evacuation Flight, and No. 848 Squadron, R.N., logged some 50,000 hrs. and 118,000 sorties in jungle support flying. Nos. 84, 52 and 110 Squadrons of the F.E.A.F. Transport Wing, No. 41 Squadron, R.N.Z.A.F., No. 38 Squadron, R.A.A.F., and the Far East Communication Squadron, using Dakotas, Valettas and Bristol Freighters, plus seven other types, flew over 37,000 sorties on supply dropping, trooping and transport flights mostly from Kuala Lumpur.

Although based on Singapore Island throughout the emergency, No. 81 Squadron operated P.R. sorties with Ansons, Spitfires, Mosquitos, Pembrokes, Meteors and Canberras and, with the exception of the last type, used K.L. as a transit base for many flights. No. 656 A.O.P. Squadron was at K.L. for 12 years, 10 under F.E.A.F., and two with the Army. As an R.A.F. unit No. 656 flew over 143,000 sorties.

Commonwealth support included the dropping of over 33,000,000 lb. of bombs in 4,000 sorties by Lincolns of No. 1 Squadron, R.A.A.F., from 1950 to 1958, and strikes by Canberras of No. 2 Squadron, R.A.A.F., and No. 75 Squadron, R.N.Z.A.F. Between 1955-58, No. 14 Squadron, R.N.Z.A.F., Vampires and Venoms logged 630 sorties. During the last two years of the emergency R.A.A.F. Sabres of Nos. 3 and 77 Squadrons at Butterworth have also undertaken strikes, including two totalling 68 sorties.

Bomber Command

AIR COMMODORE J. E. JOHNSON, C.B.E., D.S.O., D.F.C., is to become Senior Air Staff Officer at No. 3 Group, Bomber Command, in December. After serving for two years with the U.S.A.F. in Korea studying combat tactics, he commanded R.A.F. Wildenrath and later became Deputy Director, Tactical Operations, at the Air Ministry. In December, 1957, Air Cdre. Johnson took over command of R.A.F. Cottesmore.

The identical appointment with No. 1 Group at Bawtry is to be taken over by Air Cdre. P. E. Warcup, C.B.E. Serving as S.P.S.O. of No. 205 Group in the Canal Zone from 1950 to 1953, he was in the Directorate of Plans at the Air Ministry in the mid-1950s. In January, 1957, Air Cdre. Warcup took over command of R.A.F. Kuala Lumpur.

R.A.F. Appointments

THE following are among recent Royal Air Force appointments:—

Air Ministry: Wg. Cdr. K. H. Miles, A.F.C., to the Department of the Chief of the Air Staff; Wg. Cdr. P. H. Reason to the Department of the Air Member for Personnel.

Fighter Command: Gp. Capt. S. Williams, O.B.E., to Headquarters, No. 12 Group, as Senior Technical Staff Officer.

Coastal Command: Gp. Capt. A. J. Trumble, O.B.E., to R.A.F. Aldergrove to command.

R.A.F. Germany: Gp. Capt. G. Young to Headquarters for staff duties.

Far East Air Force: Gp. Capt. G. B. Morgan, T.D., M.A., to Headquarters as Command Education Officer; Wg. Cdr. F. O. Barrett, D.F.C., to Headquarters for exercise planning duties; Wg. Cdr. S. A. Fentum to R.A.F. Seletar to command the Technical Wing.

British Forces Arabian Peninsula: Gp. Capt. A. S. Knowles, O.B.E., A.F.C., to Headquarters as Senior Technical Staff Officer; Wg. Cdr. A. L. Cornford to Headquarters for equipment duties.

Other Appointments: Wg. Cdr. A. Mills to Allied Forces Northern Europe as Staff Officer (Logistics).

O.B.S. OPERATORS.—Equipped with Twin Pioneers, No. 78 Squadron (Sqn. Ldr. J. H. Phillips) completed two years of operation in Aden on Nov. 11. The Squadron's pilots claim to be the "oldest, boldest and slowest" in the Service.

The Future of Aero-electrics and Electronics

"IT is important to recognize the unity of electrics and electronics. While power generation in aircraft was in the past a purely electrical matter, many electronic techniques are now used in its control and in both aircraft and missiles it is difficult to draw any hard dividing line in the spectrum of devices from power generation to strictly electronic radio equipment. The central thread in this spectrum is the steadily increasing complexity of all the devices and techniques."

This point was made last Friday by Lord Caldecote, executive director, guided weapons, of the British Aircraft Corporation, in a lecture on "The Future of Electrics and Electronics in Aircraft and Guided Missiles." In it he surveyed power generation and distribution; components and techniques; flight-control; navigation and guidance systems; communication; and future developments.

Lord Caldecote was lecturing to a joint meeting of the Royal Aeronautical Society and the Institution of Electrical Engineers. These societies have set up a joint committee to promote discussions about their common interests in aeronautical electrical engineering, and Lord Caldecote's lecture was the first of a series which is to be arranged.

Summarized hereafter are some of the interesting and significant developments which he discussed in his paper.

Aircraft Power

For many short-range passenger aircraft the 28-volt DC system will continue to provide an adequate and economical arrangement, especially because developments have allowed the use of semi-conductor regulators with or without magnetic amplifiers. Also, the advent of the brushless generator has eliminated problems of brush wear. But the high currents in such low-voltage DC systems will limit their power to about 12 kilowatts per channel, and we must beware lest the attractive developments now possible do not introduce complexities which will detract from the basic economy and reliability of these systems.

For larger aircraft there are many obvious advantages with 200-volt 400-cycle constant-frequency systems. The ultimate goal is to provide a constant-frequency AC system without complex mechanical constant-speed drives and their associated governing and control problems, but with the ability to parallel channels when desirable. A solution is the so-called variable-speed constant-frequency system (VSCF).

The advent of the silicon rectifier and power transistors has made possible the development of static frequency changers of comparatively large power. These can form the basis of a system fed by a brushless generator, driven at engine speed, and delivering AC power at constant frequency via the frequency changer controlled by a crystal oscillator, tuning fork or tuned circuit.

These VSCF systems are now in the early development stage and seem likely to be lighter, cheaper and more reliable and efficient than any previous system. They should be very suitable for a supersonic airliner and should be available in time if their development is actively pursued.

As far as generating equipment is concerned, reliable brushless machines, both AC and DC, are now in service. These are likely to be steadily improved over the next decade without any fundamental changes. At first sight the solid-rotor alternator seems to have many advantages for the future: the rectifiers are stationary, there is no rotating winding, and the operating temperature is high. But experience so far indicates that these machines will be heavier, and there are many problems in construction, not all of which have been overcome. It is too early yet to decide to what extent they will replace brushless machines with wound rotors, which are proving reliable and efficient: further development and investigation are required.

Microminiaturization

Of new developments in components and techniques, microminiaturization probably has the widest application and is likely to have an increasingly important impact in the future. Developments are now proceeding along three distinct lines. The first is the flat component, the second is the flat circuit and the third, and more distant, the solid circuit.

Three separate objectives can be distinguished in each of these. First is the production of a high ratio of useful to parasitic mass and volume of the electronic parts. Secondly, these techniques aim at a minimum of internal hand-made connections. Third aim is the elimination of internal non-productive mass such as sockets, connectors and protective coverings.

The flat-component technique relies on standardizing the size and shape of all components. Components can take the form of circular wafers which are stacked with interleaving insulating material, the circuit being formed from a stack of elements connected on the outside of the wafers. Such units are known as micro-modules.

The flat-circuit technique involves forming complete circuits on the surface of small insulating plates. Active elements such as transistors, like minute aspirin tablets, are inserted into recesses and connected to the remainder of the circuit.

Lord Caldecote, executive director, guided weapons, of the British Aircraft Corporation.

The solid circuit technique is probably the nearest to the ultimate solution of the microminiaturization problem; the idea is based on developments in solid-state physics. It has now been found possible to build on a single crystal of semi-conductor material a series of transistors, diodes and resistances by suitably processing minute areas of the crystal surface. Thus, a complete block of circuitry is created on the semi-conductor material itself. Application of the solid circuit is being actively studied, but it will be many years before this technique will be an economic proposition in aircraft.

Flat-component and flat-circuit techniques may be developed rapidly over the next 10 years, although expert opinion differs on the relative merits of these two methods. The former can be used where the time from circuit design to manufacture must be kept as short as possible. But the flat circuit is a less flexible technique and is more suitable for application where changes in circuitry are less likely, allowing the design to be frozen at an earlier stage, and for quantity production.

The technical problems associated with these two techniques are also somewhat different. The main difficulty with the flat component is to make the side connections. The problem with the flat circuit is to produce a number of different components both reliable and to a close tolerance so as to ensure that the completed circuit will be within specification.

Communications

Progress in the detection of useful signals in the presence of noise would be of great benefit. Extraction of weak signals demands correlation techniques which are to some extent analogous to the problem of meeting a stranger at a railway station. If very little is known which will distinguish the wanted person from the crowd, the chance of spotting him is small. The more we know about him, the better the chance of distinguishing him. So it is with a signal submerged in a background of noise: if we know something about it we can correlate it with a replica of the expected signal and will thus be able to detect the presence of the signal in spite of the surrounding noise.

These correlation techniques demand extremely complex circuits containing numbers of matched filters. The advent of semi-conductors and microminiaturization will considerably help the designer in this difficult problem. These developments could make an important contribution in both missiles and the automatic transmission of information to and from aircraft.

An extension to this technique was announced in September at the Symposium on Information Theory. Three American scientists from General Electric described a new technique called "adaptive wave form recognition" which has demonstrated the ability to detect signals buried in noise and to adapt the circuit parameters continually for optimum reception.

Due to the vagaries of the ionosphere and the severe electrical noise experienced, none of the frequency bands currently used

for long-range communication is ideal. The best final solution may well be with communication satellites allowing the use of VHF and UHF frequencies.

ATC Radar

In air traffic control separate radars are normally used for surveillance and for tracking individual aircraft while they are guided to the final approach point. The development of "track-while-scan" radar attempts to combine both these functions into one system. As the radar searches the sky electronic gating techniques are used to examine a selected volume of air space about a particular echo during each scan of the system. Repositioning the tracking gates at each scan allows the volume around the predicted position of the echo to be examined and so permits the relative velocity to be extracted. This repositioning is accomplished by computers and the number of aircraft which can be tracked is dependent on the number of computer channels. A similar system might well be developed for airborne collision-warning radar.

Inertial Techniques

An advanced idea for inertial navigation is the particle gyro making use of the angular momentum of rotating particles. The particle gyro looks very attractive in that it may be purely electronic, although so far it appears to have progressed only as far as the initial research stage. There is no doubt that some of these developments will make rapid progress during the next 10 years, making available gyros with very small drift rates suitable for inertial-navigation systems in vehicles with long times of flight, such as long-range aircraft and space vehicles.

There will also be further progress towards microminiaturization of both gyros and accelerometers. There are some interesting possibilities with accelerometers using the vibrating string principle with electrical pick-offs or the piezo-electric effect in crystals, but the problems of stable operation in a changing environment have not yet been solved.

Reliability

Complication will increase with the greater demands that we make on aeronautical vehicles of all types, and the more complex the systems which we install in aircraft, missiles and ultimately space vehicles, the greater is the necessity to concentrate on reliability. This is not only for economic reasons but also because the more functions which are carried out by electrical devices, the more dependent we are upon them for safety of the vehicles as a whole.

One of the most important developments of the next few years, apart from the search for greater reliability itself, will be the development of comprehensive testing arrangements for all the electrical and other devices. Much has already been done in this direction for missiles and the experience should be used in the aircraft to provide overall testing arrangements which will both detect a fault and diagnose the cause. This must be achieved without wholesale breaking of connections which is in itself such a frequent cause of unserviceability.

Thunderbird's Future

RECENT doubt about the future of the English Electric Thunderbird SAM was resolved on Oct. 7, when Mr. John Profumo, Secretary of State for War, announced that it was intended to equip the British Army with a new Mark of this missile. His statement read:

"The Army must have the best possible anti-aircraft protection to meet the challenge of modern war. We believe that Thunderbird answers this requirement better than any other system. The Government have, therefore, decided to authorize the completion of the development of this sophisticated weapon and, providing everything goes as well as up to the present, we intend the British Army shall be equipped with a new Mark of this weapon as soon as possible. Preliminary trials with the early Mark of Thunderbird have been going well and the Army is already getting useful experience in handling and maintaining these modern and extremely lethal missiles."

The new version of the Thunderbird differs in many respects from the initial one; in particular, it has greatly improved guidance of the CW type. The initial version is now in limited service with the British Army.

Hawkeye for U.S. Navy

GRUMMAN'S latest aircraft is the W2F-1 Hawkeye, which made its first flight on Oct. 21. Powered by two Allison T56-A8 turboprops, it has been designed for the U.S. Navy to replace the Grumman WF-2s used for airborne early warning. It is claimed that the Hawkeye can fly higher, faster and for a longer duration than any other carrier-based early-warning aircraft. It has a crew of five.

The W2F-1 will be used to protect U.S. Navy task forces from air attack by detecting and assessing the threat early enough to ensure the successful interception of high-speed aircraft. This demands an early-warning system with an "unprecedented" reaction time between the detection and destruction of attacking aircraft. The necessary radar equipment has to be very accurate at extreme range. After detection it has to identify, track and evaluate the threat and to exercise direct command and control over task-force interceptors.

The nerve centre of the Hawkeye is its airborne tactical data system. This consists of very advanced auto-detection radar, airborne computers and a memory and high-speed data-link system. This automatic system is monitored by the aircraft's crew. The Hawkeye has a large revolving radome above its fuselage; this houses the antennae for its high-resolution radar.

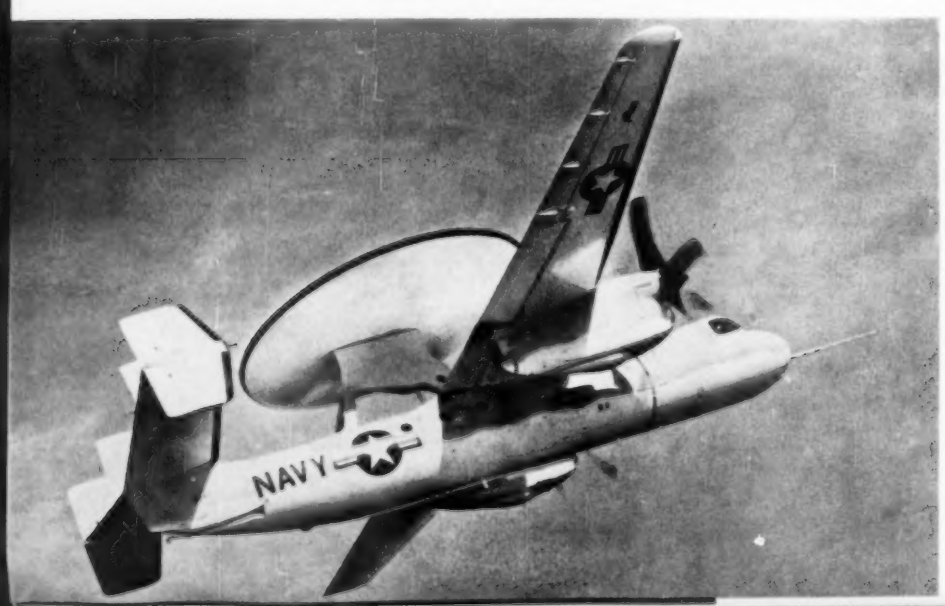
Teams of these aircraft will circle seagoing task forces, forming an umbrella of early warning radar protection which is hundreds of miles in diameter. When an attacking aircraft is detected the ATDS system will track it and transmit information by data link to the naval tactical data system, normally located at the task-force headquarters. This provides an overall picture of the whole tactical situation; it also relies on information from submarines and land- and ship-based radar.

Technical Data

DIMENSIONS.—Wing span, 80 ft. 7 in.; length, 56 ft. 4 in.; height, 16 ft.

WEIGHT.—Max take-off weight, 49,500 lb.

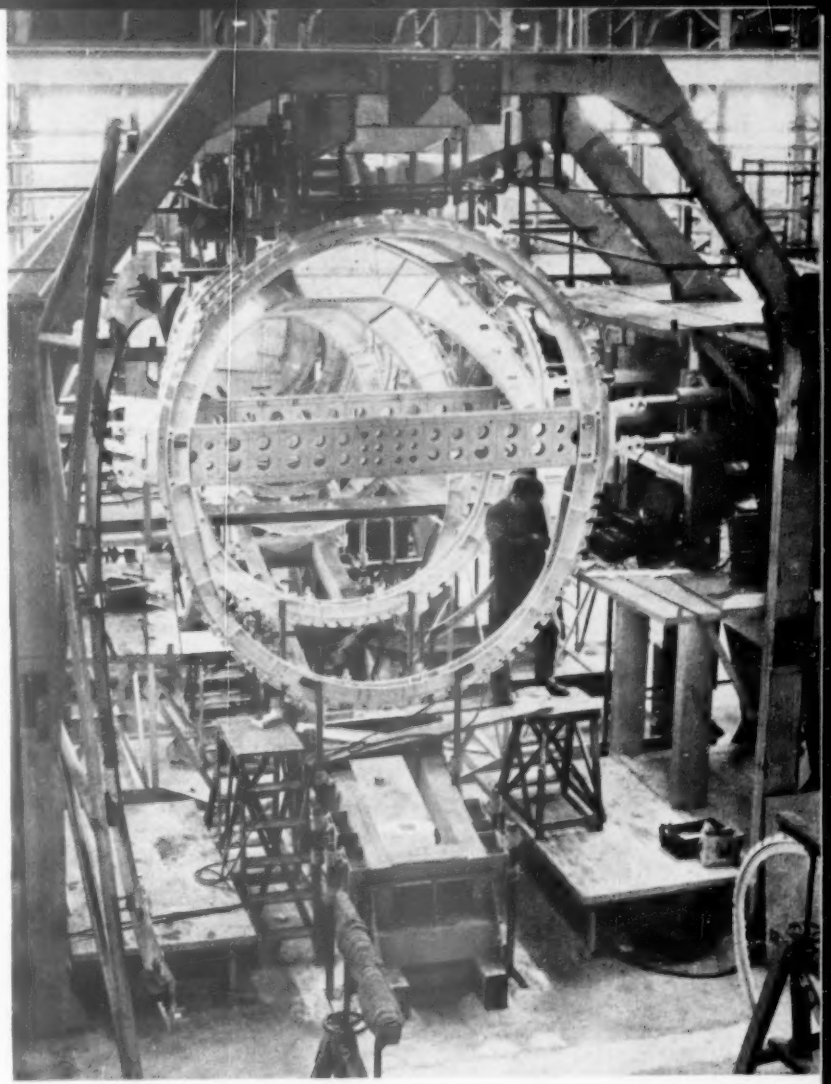
POWERPLANT.—Two Allison T56-A8 turboprops, each giving 4,050 e.s.h.p. for take-off.



REVOLVING EYE.—Characteristic of the Hawkeye is its large revolving "rotodome." This can be raised and lowered. The aircraft's wings can be folded for hangar-deck storage.

Structural Features of the VC10

This article is the first of a series planned to deal with selected facets of the design and application of the Vickers VC10. Other articles in the series, to appear over the next twelve months, will deal with:—Operational aspects; flight-deck engineering and navaid equipment; pressurization and air conditioning systems; and the control systems layout. These articles, coupled with the full development story and the customary cut-away drawings, will form the most comprehensive account available of this outstanding British airliner.



ALTHOUGH the Vickers VC10 represents some advanced thinking as a second-generation civil turbojet transport, the underlying philosophies applied to the detail design of its airframe are based on well-established first principles which have come to be adopted over the years as a reliable means to structural integrity. For example, in broad terms the Vickers team prefer to design to a combination of safe-life and fail-safe techniques rather than to concentrate on one to the exclusion of the other. This basically means the adoption of low stress levels in the skin—and the consequent use of the copper-based aluminium alloys—while the underlying structure is designed to have the alternative load paths necessary to meet the requirements of a fail-safe technique.

Applications of these philosophies are illustrated in the accompanying sketches which also include detail illustrations of some of the many ingenious design features to be found in the VC10's airframe. These features are described, in the broadest of terms, in this article which is intended to be an overall survey rather than a detailed analysis of all the problems faced and solutions found.

Likewise, it is not our purpose here to discuss the relative merits of rear-mounted engines versus wing-mounted podded powerplants for the VC10—except in so far as they concern the structural desiderata—for this has been done in a previous article (THE AEROPLANE AND ASTRONAUTICS, Nov. 20, 1959). In this context, the sort of thing that comes to mind as relevant is the problem of the loads that arise from powerplant nodding in the case of long slender nacelles or in podded installations and their effect on the wing structure. Removing the powerplants from the wing and mounting them on the rear fuselage removes one set of structural problems but cannot fail to introduce others.

Wing-mounted engines provide a healthy measure of bending relief and, therefore, they offer the possibility of having a lighter wing structure. The "clean" wing that is aerodynamically—and economically—desirable, is essentially a heavier—

Above, the rear-fuselage frames in the assembly jig; note the vertical frames carrying the engine mounting beams and the sloping fin-spar frames.

Left, this view of a model of the VC10 shows to advantage the arrangement of its high-set tail, engine installation and swept wing.

VC10 . . . .

and, therefore, less economic—wing. But to counterbalance this adverse effect of moving the engines away from the wing there is apparently some evidence to show that a stiffer wing has considerably lower maintenance and overhaul costs than a flexible one.

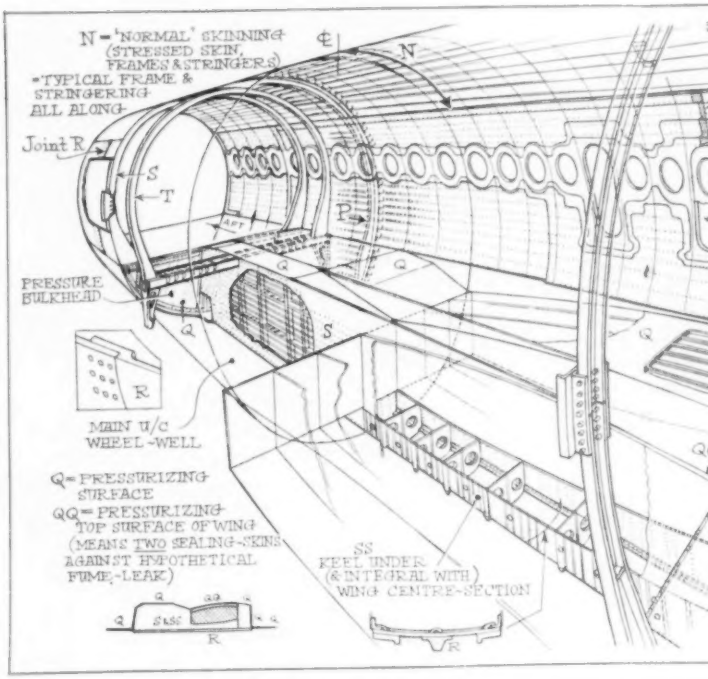
On the score of weight penalty, a figure of 2-4% on structure weight has been given on the debit side of the rear-engine layout. On the other hand, it has also been said that each of the structural problems contributing to this weight penalty will result in an aerodynamic gain that will more than compensate for it.

The structure of the VC10 as a whole is of considerable interest because of the extensive use that has been made of integrally stiffened machined components. In point of fact, something like 55% of the basic airframe is represented by major items machined out of solid billets instead of being fabricated.

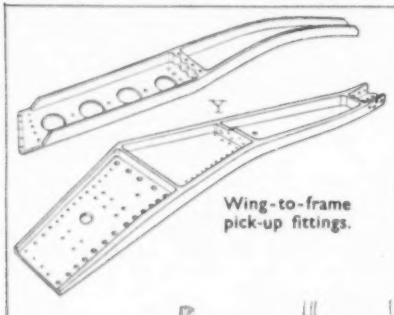
In the fuselage, for instance, a particularly noteworthy example is to be found in the skin panels in way of the window cut-outs. These are areas where, inevitably, the stress levels tend to be high. By machining the skin in this region out of solid planks of L72 and having integral stiffening rather than secondary doubler plates, something nearer the ideal uniformity of stress level is obtained. In consequence, the finished panel is lighter overall; and there are substantially fewer crack-raisers in the guise of rivet holes and the like. These panels are, incidentally, machined flat and then formed to the correct fuselage contour.

Throughout the fuselage, the basic structure comprises channel-section hoop frames on the outside of which, between them and the skin, are continuous top-hat section stringers. To transfer the loads from the skin into these principal frames, there are secondary angle-section outer frames (notched to take the stringers) which are attached directly to the skin and to the inner channel frames. The stringers which are, of course, also riveted to the skin panels are attached to the frames by means of riveted cleat fittings.

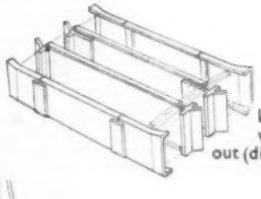
By these means, a complete fail-safe structure is achieved. If the outer, secondary, frame fails, the inner, principal, frame will remain intact to carry the load. If a principal frame should fail, the secondary frame attached to it will provide an alternative load path. And should a skin crack develop it will be contained by the closely spaced stringers and secondary frames.


N='NORMAL' SKINNING (STRESSED SKIN, FRAMES & STRINGERS)
-TYPICAL FRAME & STRINGERING ALL ALONG
Joint R
PRESSURE BULKHEAD
MAIN U/C WHEEL-WELL
Q=PRESSURIZING SURFACE
QQ=PRESSURIZING TOP SURFACE OF WING (MEANS TWO SEALING-SKINS AGAINST HYPOTHETICAL FUME-LEAK)
SS KEEL UNDER (& INTEGRAL WITH) WING CENTRE-SECTION

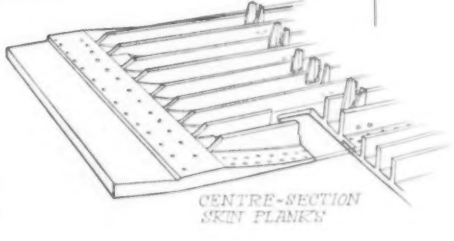
CENTRE-WING DETAILS



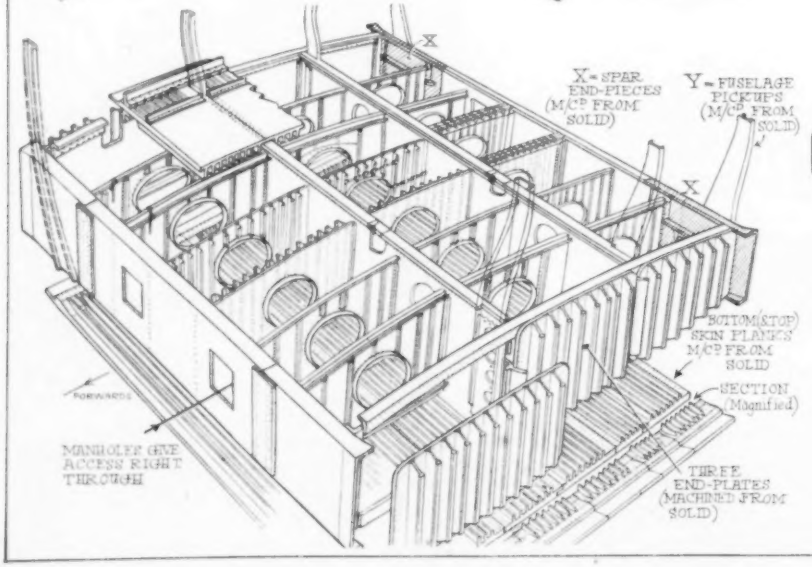
Wing-to-frame pick-up fittings.

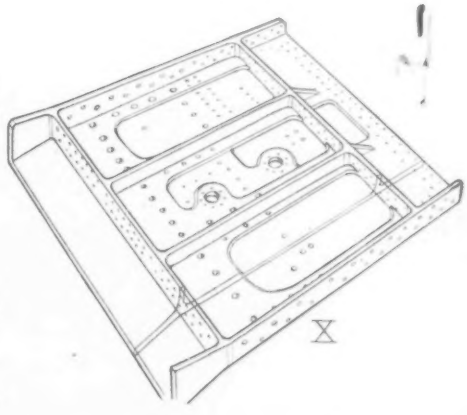


Left, centre-wing spar lay-out (diagrammatic).



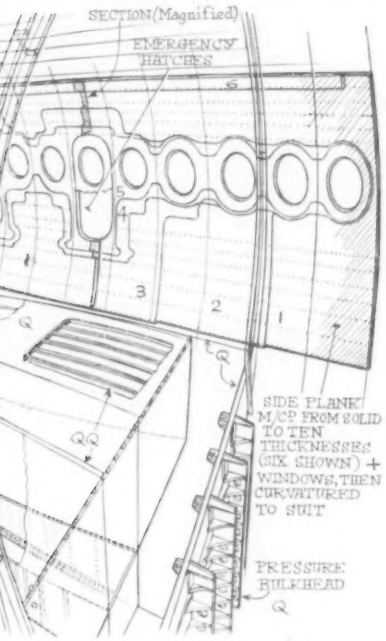
CENTRE-SECTION SKIN PLANKS

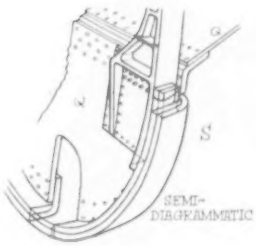


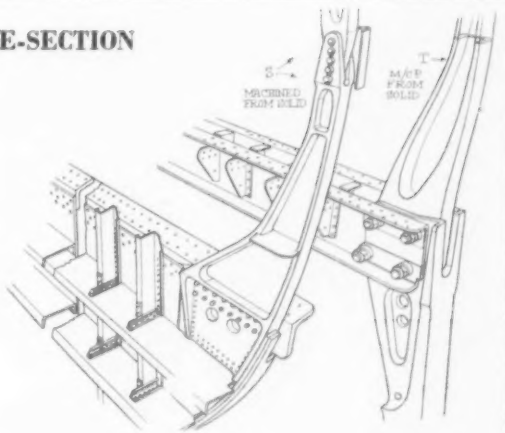


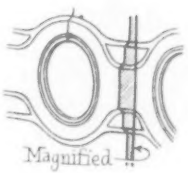
Above, wing spar end-plates (see "X" at main view, left).

FUSELAGE CENTRE-SECTION









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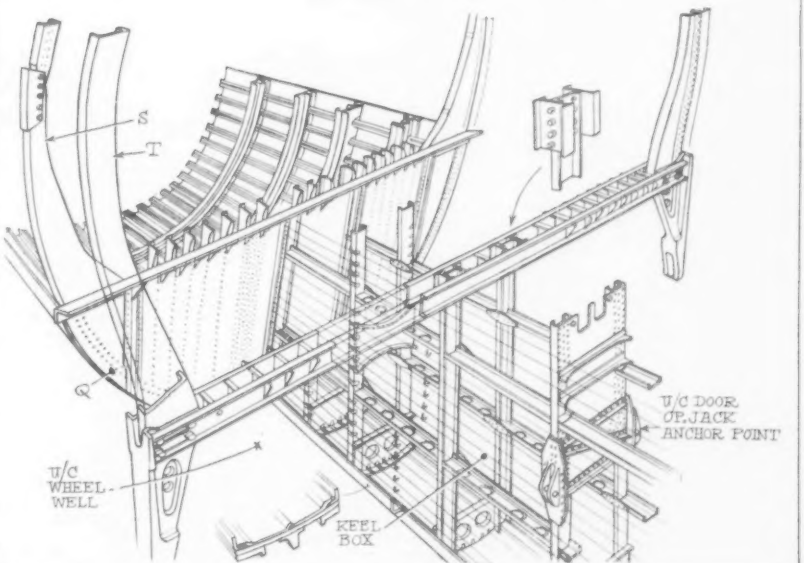
Above and above left, frame attachment details.

Left, section through the machined fuselage panel.

Below, details of the keel box and spine members.



In the front fuselage the skin panels are 17 s.w.g. Over the top portion of the fuselage where the hoop stresses from the pressure loads are high (the VC10 has a 9-p.s.i. differential), these panels are laid transversely with circumferential strap joints between panels. In the lower portion, on the other hand, longitudinal joints have been used.

This latter system also applies, of course, to the machined window panels. These are assembled to the underlying frame and stringer structure in exactly the same way as the other skin panels except that they have longitudinal lap joints (instead of butt strap joints) to the skin panels above and below them.

Although not, perhaps, a feature that comes strictly under the structural heading, the windows themselves are of some interest. They are, in fact, of the triple-pane type in which the outer pane is designed to carry the full cabin pressure. It does so, however, at a lower factor than the centre pane which, in effect, forms part of the main pressure-cabin skin. The inner pane is "non-structural" and serves to protect the pressure-carrying centre one. Each of the three panes is mounted independently so that there are no noise transfer paths.

In the centre fuselage, which accommodates the wing and main-wheel bays in its lower portion, it is necessary to preserve the pressure floor above the extensive cut-out and to restore the bending strength along its length by some form of keel member. To this end, aft of the wing centre-section in the fuselage there is a sturdy keel box, 20 in. wide, which separates the two main-wheel bays in the lower portion of the fuselage. Forming the bottom of this keel box and extending right forward under the wing centre-section to the centre fuselage front frame is a massive built-up plate spine member. Under the wing centre-section two vertical fore and aft keel webs spaced 20 in. apart and coinciding with two wing diaphragms extend down to the spline member to form in effect a shallow continuation of the rear keel box.

The pressure floor over this portion of the fuselage comprises a horizontal diaphragm between the forward bulkhead frame and the wing centre-section front spar; the top surface of the wing centre-section torque box; and the top of the rear keel box with extensions out to the fuselage side. Stiffened plate bulkheads in the lower portions of the forward frame and the cut-out end-frame complete the pressure box.

Wing loads are transferred into the fuselage by I-section machined frames at the wing spar positions. Because the loads involved are high, the scantlings of these frames would be very large if they were to be made of light alloy. Hence, on the score of space-saving, steel is used.

These steel frames are bolted to the ends of the centre-section spar booms and webs. The two middle ones form, in effect, part of the centre-section structure, while the more accessible end frames are attached to the spars during the final assembly phase.

Behind the rear centre-section spar in the under fuselage is a built-up cross-beam structure across the top of the keel box and extending to the fuselage sides. This provides pick-up points for a fifth machined fuselage frame, of light-alloy, which carries the undercarriage side-stay loads.

In this centre-section and wheel bay portion of the fuselage

REAR FUSELAGE DETAILS

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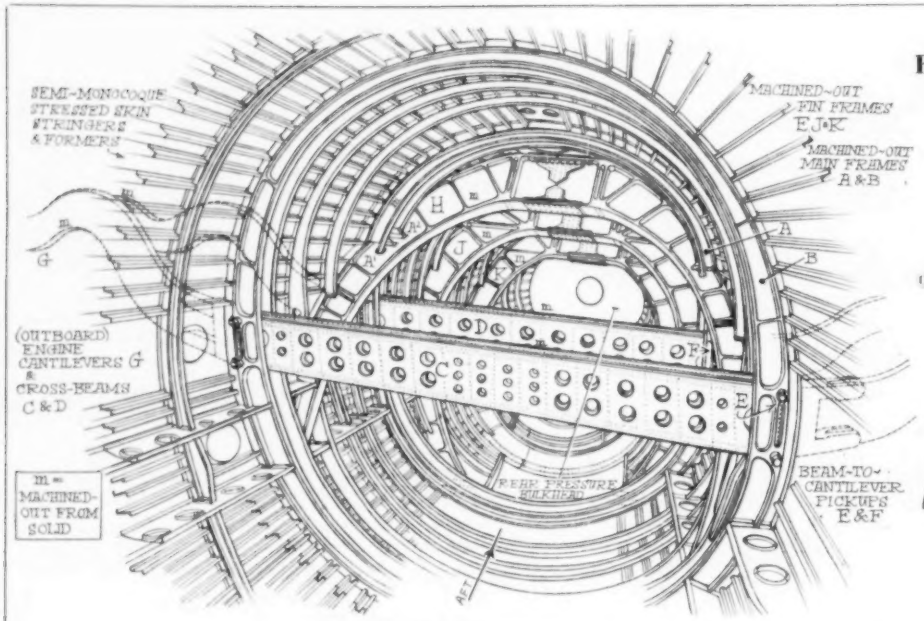
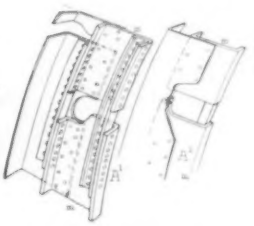
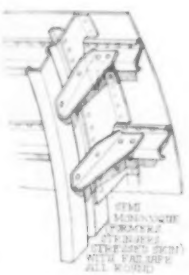
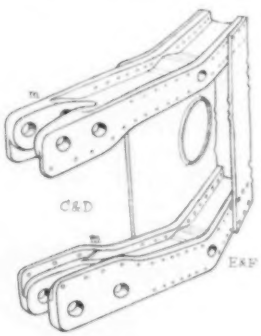

SEMI-MONOCOQUE STRESSED SKIN STRINGERS & FORMERS
MACHINED-OUT FIN FRAMES E,J,K
MACHINED-OUT MAIN FRAMES A&B
(OUTBOARD) ENGINE CANTILEVERS G & CROSS-BEAMS C&D
m = MACHINED-OUT FROM SOLID
REAR PRESSURE BULKHEAD
BEAM-TO-CANTILEVER PICK-UPS E&F

Above, frame and cross-beam assembly in the rear fuselage.

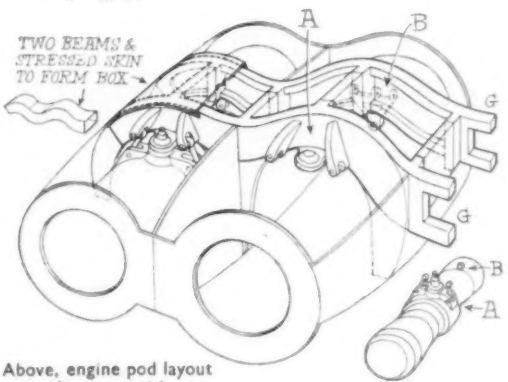


Above, frame detail.





Above, frame and stringer attachment. Right, engine beam pick-up fitting.



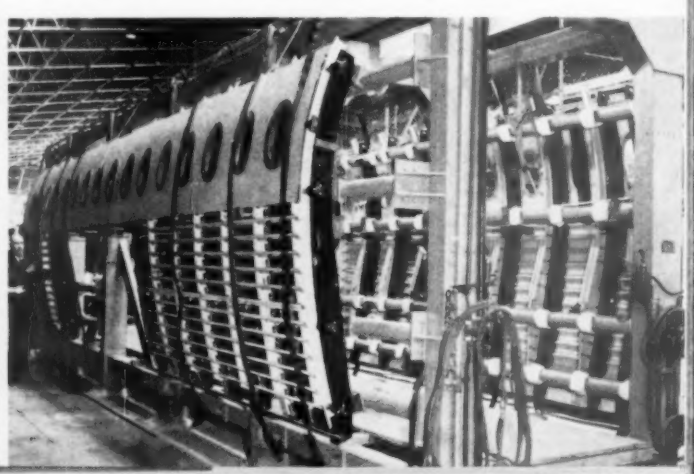
Above, engine pod layout (diagrammatic).

the pressure floor is well below the actual cabin floor. The cabin floor panels are, in fact, supported on closely spaced fore and aft beams over the top of the wing centre-section and by angle members at the fuselage side.

A region of considerable interest in the VC10's structure must inevitably be the rear fuselage which carries the four engines and tail unit, and here the airframe appears at first sight to be somewhat complex. Rather as one would expect, however, there is nothing fundamentally difficult about the structural problems to be faced in a rear-fuselage-powerplant configuration and, on closer inspection this complexity turns out to be something of a false impression. Nevertheless, there are obviously some matters of detail concerned with, for example, rear fuselage strength and the means of attaching the powerplants to the fuselage structure, that need some special consideration.

Generally speaking, for the rear portion of the fuselage structure, the skin panels are of a heavier gauge and the stringers are changed from top hat sections to Z sections. And

Below left, the centre fuselage in the jig with the machined window panel in place. Below, the forward fuselage being assembled; note the close frame and stringer spacing.

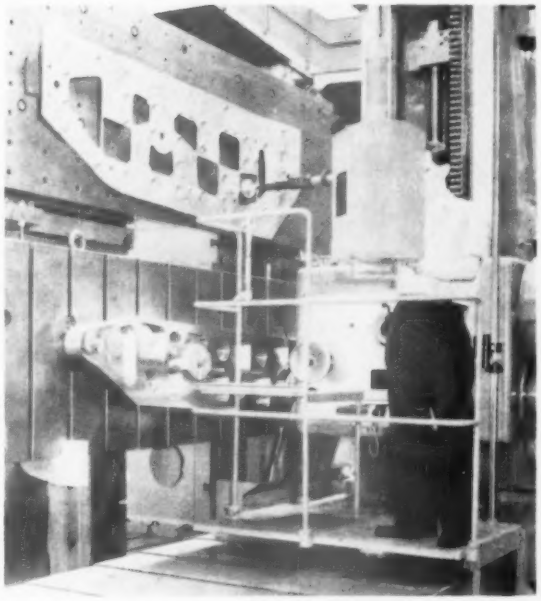


VC10 . . . .

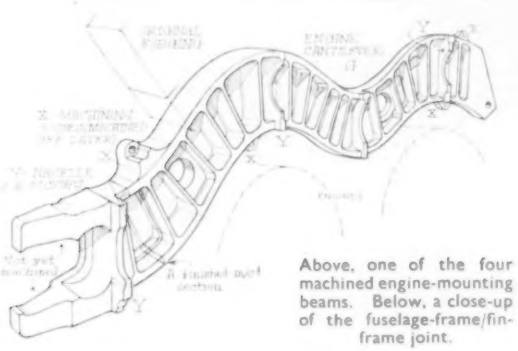
the need to accommodate engine bearer loads as well as fin spar loads has tended to lead to a closely knit arrangement of normal and diagonal frames.

Again one finds the extensive use of machined components. For example, in the rear fuselage there are two sturdy machined light-alloy frames to which are attached horizontal cross-beams built up from H-section steel booms and light-alloy web-plates. These frames are double units comprising channels placed back-to-back each side of the cross-beams. They follow the practice adopted for the remainder of the fuselage in being inside the stringers and having notched angle-section secondary outer frames for attachment to the skin.

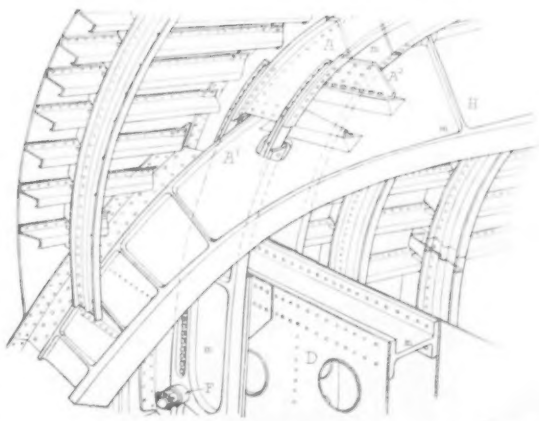
To the frame cross-beams are attached the engine mounting structure proper. This is in the form of a pair of half-spectacle shallow torque-boxes for which the front and rear spars are machined from I-section high tensile steel billets and the top and bottom skins are stainless steel sheet supported by stringers.



Above, machining the main undercarriage beam in high tensile steel; the billet weighs a ton before machining and the finished component weighs 340 lb.



Above, one of the four machined engine-mounting beams. Below, a close-up of the fuselage-frame/fin-frame joint.



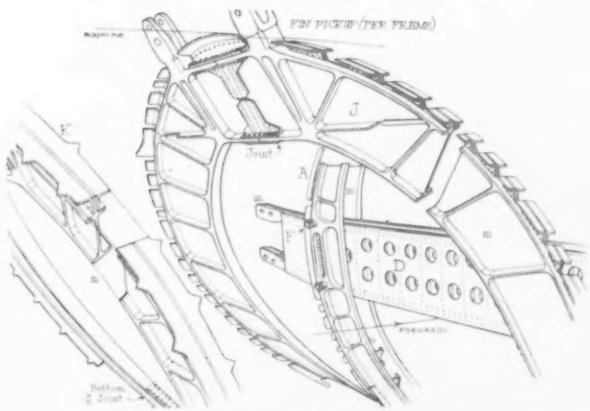
The engines are slung from these mounting beams on three pick-up points each.

As the three fin spars are swept back at some 40°, the corresponding pick-up frames which diffuse the tail loads into the fuselage are also sloping aft by a like amount. These are I-section light-alloy frames machined from the solid in halves and bolt-jointed. The secondary outer frames in this instance are T-section units formed by back-to-back channels.

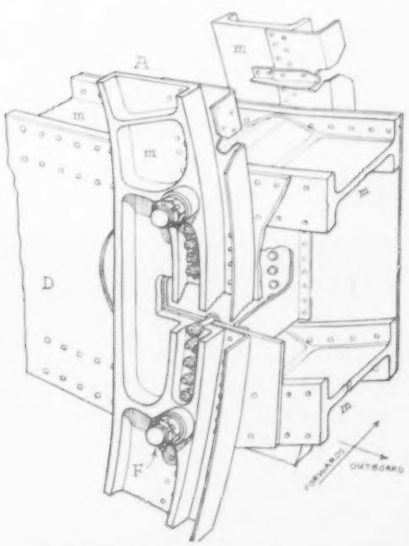
All this structure is pressurized, for the rear pressure dome is quite a small unit located right aft under the fin. The frames have been particularly designed to enclose the rear freight hold without encroaching too much on its available volume.

The fin spars are, incidentally, all load carrying and form part of a basic fail-safe structure. They have machined booms and plate webs and are connected by diaphragm ribs.

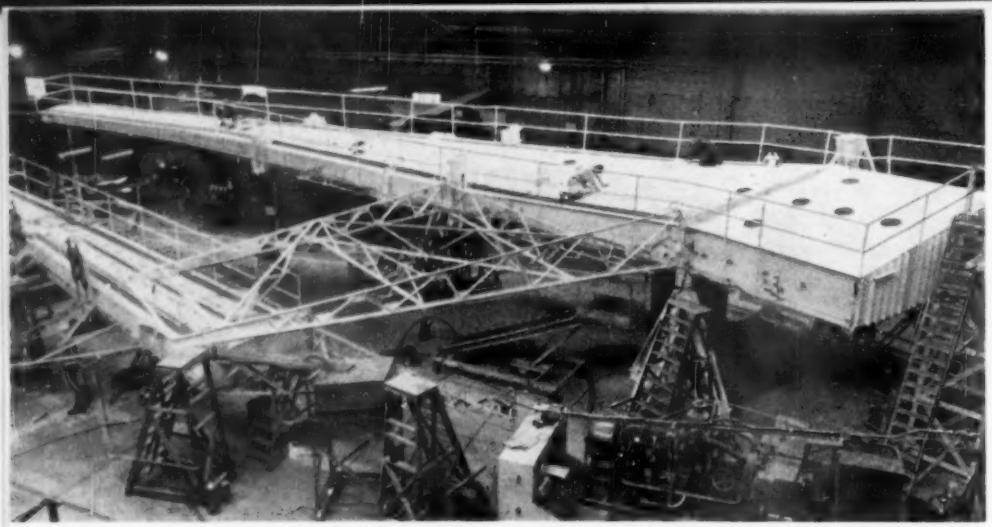
One particularly important problem with a fuselage-mounted



A fin-frame and fin-spar pick-up.



Engine mounting cross-beam and frame structure.



A full-scale VC10 wing was built in mild steel for fuel-flow tests. By way of comparison, a similar test Vanguard wing can be seen in the left foreground.

engine layout is that of the structural safety of the pressure cabin in the event of a turbine disc failure. Provided that the fuselage skin has adequate tear stoppers in the form of a closely spaced stringer and frame system, the problem largely becomes one of preventing an explosive decompression rather than structural disintegration.

A great deal of study has been devoted to this problem in relation to the VC10's rear fuselage structure. It is considered that the worst possible hole that might be caused by a turbine failure would not prove disastrous to the structure because of the many alternative load paths provided. Likewise, by carefully routeing the control runs in this part of the fuselage and by full duplication of hydraulic and electrical systems in the tail area, the Vickers team are confident that the worst damage could affect only 50% of any one system and put nothing vital entirely out of action.

On the score of pressure loss, the largest hole so caused is reckoned to be no greater than the loss of a window. And the pressurization equipment is designed to maintain the cabin pressure in those circumstances.

The wing of the VC10 is, perhaps, even more structurally orthodox than the fuselage so far as overall conception is concerned. Indeed, because there are no engine mounting problems, the structure tends to be somewhat simpler than most—although, as already mentioned, the lack of bending relief from wing-mounted powerplants leads to an overall sturdier structure.

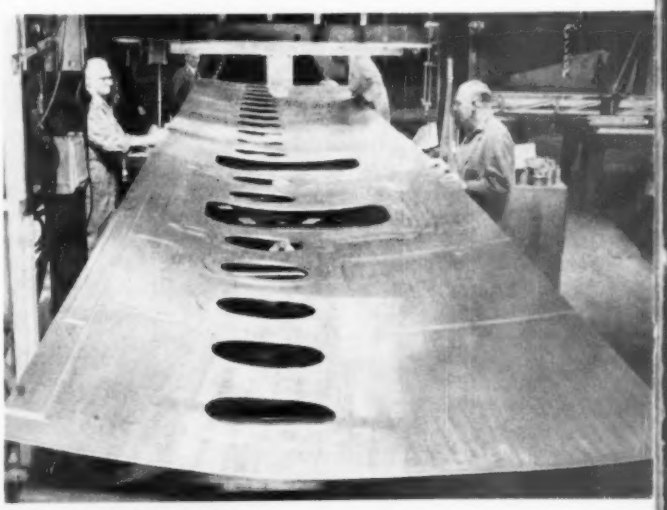
Its principal interest lies in the adoption of an extremely high proportion of machined skin. In point of fact the area so covered is considered to be higher than that in any other aircraft. Of a total wing surface area in the region of 5,600 sq. ft., no less than 3,000 sq. ft. are covered by machined planks.

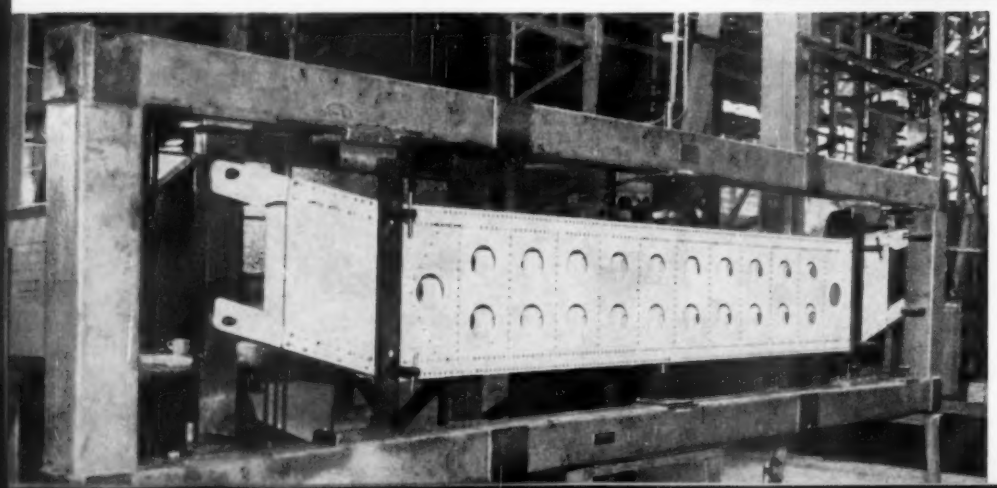
The centre-section and inner-wing units are four-spar structures while the outer wings—amounting to about half the semi-span—have three spars. The front and rear units in each case, with extruded T-section booms, are the major shear webs for the torsion box, while the intermediate units are similar but of somewhat lighter construction.

The plate skins are supported by a large number of closely spaced diaphragm ribs. These are mostly of the built-up plate type but there are seven machined ribs. Four of these are deep units in that they extend to the skin profile; in these cases the integral skin panel stringers are cut away to accommodate the rib and the actual skin thickness is locally increased to replace the stringer stabilization. The other machined ribs follow the practice adopted for the remainder by being inside the skin stringers and cleated to the skin surface proper.

Although, as already mentioned, the tendency throughout the structure has been to use copper-base alloys for the skin this is not the case for the upper wing surfaces. For this compression skin a higher-strength zinc-based alloy is used. Another point of general interest in the overall wing structure is that in the lower (tension) surface access-holes have been avoided to mitigate the possibility of stress concentration and possible fatigue problems.

During the past few years, it has become an accepted fact of aeronautical development life that comparatively simple structures fabricated largely from thin sheet materials and embodying a minimum of machined parts are gradually becoming things of the past. Even in the case of the present generation of faster and larger aircraft, the beginnings of a structural revolution have been very noticeable. And when one studies the component parts of such next-generation aeroplanes as the VC10 it becomes most apparent that for the next steps something approaching "heavy engineering" techniques taken to their ultimate refinement has become the order of the day.—F. T. MEACOCK.





Above, a 34-ft. machined window panel for the centre fuselage; after milling, these panels are contour-formed in a 300-ton press.

Left, one of the two engine-mounting cross-beams which are sandwiched between frames in the rear fuselage.

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Problems of Space Propulsion

Exhaust of an arc-jet "space-engine" operating in a vacuum chamber during a 47-hr. test-run earlier this year at Avco RAD in the United States. Engine produces a thrust of 3/4 lb. with a specific impulse of 1,000 sec.

WHAT does the future hold in terms of potential propulsion energies? This was the question posed by Maj. Gen. Don. R. Ostrander, U.S.A.F., director of launch vehicle programmes, NASA, at a recent symposium sponsored by the U.S.A.F. Aerospace Medical Center and Southwest Research Institute in San Antonio, Texas. His paper, surveying this question, dealt not only with the importance of developing more energetic chemical and nuclear propulsion systems but also touched upon the important work that is now in progress in the United States with various electrical propulsion devices and other still more advanced techniques.

At the present time, said Gen. Ostrander, liquid-propellent rockets remain the key performers. Practically all the liquid-propellent vehicles in use today employ the relatively low energy propellent-oxidizer combination of kerosene and liquid oxygen, but we are moving very rapidly in the direction of liquid hydrogen and liquid oxygen. This combination gives a specific impulse exceeding 400 sec. (or 400 lb. thrust per second for each pound of fuel burned) as compared with under 300 sec. for the conventional kerosene/liquid-oxygen mixture.

The Americans have been working on a liquid-hydrogen/liquid-oxygen system for the Centaur second-stage vehicle since 1958, and expect to launch the first sometime during the summer of 1961. The Centaur will be boosted with an Atlas vehicle as a first stage and it will be capable of establishing about 8,500 lb. in a near-Earth orbit, or of carrying some 1,500 lb. to Mars or Venus.

In addition, the largest launch vehicle, the Saturn, will use liquid hydrogen and liquid oxygen in each of its upper stages. With Saturn C-1 it will be possible to launch about 19,000 lb. into a 350-mile orbit, or about 5,000 lb. on escape missions.

At the Lewis Research Center in Cleveland, Ohio, a limited amount of research and component work with liquid hydrogen and liquid fluorine, is being done. Fluorine gives a somewhat higher specific impulse but is extremely toxic and corrosive and consequently very difficult to handle.

Although liquid propellents constitute the biggest part of the present programme and give the highest currently available specific impulses, they do have their disadvantages, the speaker continued. For one thing, they require a large number of sequential operations for each successful launching. Even in the Juno II, which is a relatively small and unsophisticated vehicle, after the firing button is pressed, a total of 144 separate operations have to take place before lift-off—all in the proper sequence.

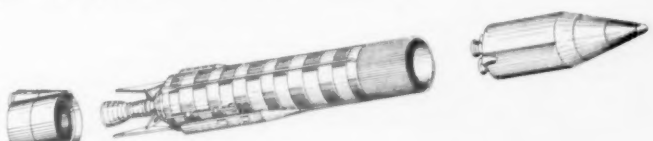
Saturn, using a cluster of eight engines in the first stage, is naturally much more complicated. For successful operation the flow of RP-1 fuel and oxygen must be carefully metered and controlled from nine tanks to each of the eight engines; sloshing of fuel and unstable burning have to be prevented; too large a pressure build-up must be avoided and, in general, smooth and stable combustion simultaneously in all eight engines has to be ensured.

Further complication is introduced by Saturn's sheer size; it is 21½ ft. in diameter and about as tall as an 18-storey office building. The handling of such a large, thin-walled, rocket presents some rather severe problems, particularly in transporting it from its place of manufacture and in its handling and erection at the launching site.

Solid-propellent rockets, on the other hand, have several inherent advantages. They are storable for extended periods of time; they are simple to operate since they dispense with turbo-pumps, valves and plumbing; they have the advantage of simple firing techniques and can be launched by relatively untrained personnel. In general they offer lower development costs and shorter development times than comparable liquid-propellent rocket systems.

To date, the major application of solid propellents in the NASA programme, other than for small research rockets, has been in the Scout vehicle. This is a 36,000-lb., four-stage rocket, about 72 ft. long, which is capable of orbiting about 150 lb. at an altitude of 300 miles.

Scout provides a good example of the advantages of solid propellents. The first vehicle was launched only 1½ years after contracts were placed for component manufacture. Launching was accomplished at Wallops Island by a crew who had no previous experience with vehicles of this size.



Drawing of the Centaur space-booster which has a LO_2/LH_2 "high-energy" top stage mounted on the nose of a modified Atlas ICBM. First launching of this combination is expected at Cape Canaveral next year.

The entire vehicle development programme, plus a new launching tower and the procurement and firing of eight vehicles, will cost about $15 million. This, said Gen. Ostrander, is relatively cheap compared with other programmes. Vanguard, for instance, was a similar scientific satellite programme in the same general vehicle weight range, but its cost was about $60 million and its payload was only 20 to 50 lb.—less than one-third that of Scout.

Design simplicity of Scout is, perhaps, best illustrated by the fact that the very first flight was a complete success except for an unfortunate personnel error. The fourth stage was given a command not to fire by the range safety people when an erroneous radar signal indicated that the vehicle was off course, when in fact it was not.

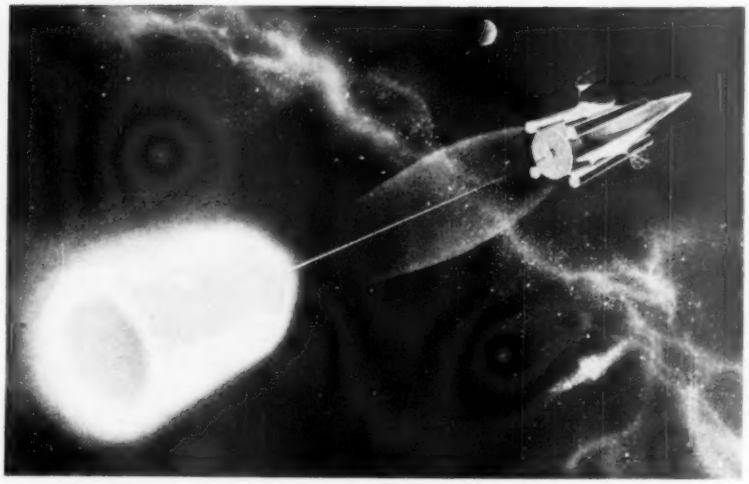
The second Scout flight, on Oct. 4, was almost too good to be true. It attained its 3,500-mile predicted altitude and 5,800-mile impact range precisely, carrying a 120-lb. payload. From data available to date, the propulsion and control systems all appeared to work perfectly.

Although the second flight was basically intended for vehicle evaluation, an Air Force payload capable of measuring radiation was carried. Telemetered information was received for over an hour of the 1½-hour flight time. An orbital experiment is planned for the next Scout firing.

The question might well be asked: if solid propellents are so promising and so cheap, why do all other NASA vehicles employ only liquid propellent? There are several good reasons for this.

As mentioned earlier, said Gen. Ostrander, launching vehicles developed by the Department of Defense are being used at present. These are available, and they use liquid propellents.

Dr. Richard R. John, who has played a leading part at Avco RAD in the development of the arc-jet rocket engine, holds the experimental unit which has been run continuously for long periods.



Artist's impression of the technique which research scientists at the Lockheed Missiles and Space Division believe may lead to the direct conversion of electrical energy to run an ionic-powered spacecraft. Launched into orbit by a large chemical rocket, the spacecraft would be separated from the reactor by a mile-long co-axial cable as protection against radiation. The reactor, glowing at a temperature of 2100 C., "boils" electrons off tiny thermionic cells arrayed around the outer shell of the reactor, thereby producing electrical energy which is transmitted through the cable to power the ionic propulsion system.

Secondly, for lunar and planetary missions such as those contemplated with Centaur and Saturn, very-high-energy upper stages with specific impulses in the liquid-hydrogen/liquid-oxygen range are required. At present there are no ultra-high-energy solid propellents available, although research is under way that may lead to useful performance gains.

Some studies concerning potential advantages of very large solid first-stage boosters, in the Atlas-Saturn size range, have been made. These look reasonably promising and additional studies have been started to determine more specifically the advantages of solid first-stage boosters for vehicles weighing up to 7,000,000 lb. All of these studies assume, of course, the use of liquid-hydrogen/liquid-oxygen upper stages.

Sectional "Solids"

It should be possible, if desired, to build a 500,000 lb. solid booster for a specific application, and subsequently cluster these to produce larger vehicles. One study now being made involves the construction of very large solid rockets from modular sections by bolting them together at the launch site, like short sections of large-diameter pipe filled with propellent.

By attaching different numbers of these sections together, it should be possible to build a rocket of virtually any size and thrust level. The sections for even a 500,000 lb. rocket motor should be small enough to be made with existing solid propellent facilities, and once built they would be easy to handle and transport by ordinary commercial means.

Solid rocket motors are fairly widely used as terminal stages in present-day space vehicles. They are especially effective in the relatively small final stages used in such vehicles as Thor-Able, Delta and Atlas-Able.

Much of the work in the solid propellent field today is directed toward reducing the weight of the rocket motor case and nozzle. For example, glass-fibre chambers and plastic nozzles of the ablating type are being developed. Among the lighter-weight nozzle systems one type has a thin metal cone cooled with a liquid metal.

Guidance of most present solid rockets is either by means of a swivelling nozzle or jet vanes. Simpler and more efficient methods are, however, being investigated. For example, one scheme involves a cluster of small movable rocket motors, attached to the main rocket. Such a cluster could continue to burn after the main rocket propellents were consumed, until a very precise velocity were attained, steering all the while. This would help alleviate one of the major problems affecting all solid rockets—that of shutting off the thrust upon reaching a precise velocity.

Atomic Propulsion

The nuclear rocket, which has been receiving increasing attention during the past year, has a tremendous potential. A three-stage Saturn with a nuclear top stage would have approximately twice the payload-carrying capability of its all-chemical counterpart. For long-range missions involving heavy payloads, it is felt that the nuclear rocket will be a leading contender, and it will warrant the heavy and quite expensive development that will be required.

In the nuclear rocket, a liquid hydrogen working fluid is heated to a high temperature by passing it through a nuclear reactor. The gas is then accelerated through a nozzle to produce a propulsive jet. The specific impulse is not limited by the chemical bond energy within the hydrogen molecule as in a chemical combustion rocket; it is limited only by the maximum temperature at which the reactor core can operate. It may be possible to obtain a specific impulse as high as 1,000 sec. compared with maximum attainable values of somewhere around 500 sec. for the liquid-hydrogen/liquid oxygen chemical rocket.

The nuclear rocket programme is jointly organized by N.A.S.A. and the Atomic Energy Commission. The former is responsible for all non-nuclear components, and for integrating the engine into a flight vehicle. A joint A.E.C.-N.A.S.A. Nuclear Propulsion Office has recently been set up at the A.F.C. Headquarters at Germantown, Maryland, to run the programme.

The first KIWI reactor was successfully static tested in the summer of 1959. Two more successful tests have been made this summer, and there are plans for a third next year. With each test, the KIWI reactor and its associated plumbing are being modified to approach more nearly a prototype flight-weight engine system. N.A.S.A. is now evaluating proposals from industry for a preliminary design study of a complete engine.

In addition, industrial contractors are engaged in parallel studies of the requirements to be met for flight testing. Also, a competition is in progress for preliminary design studies of test facilities which will be required for further ground testing of the nuclear engine and the nuclear-powered vehicle.

Electrical Propulsion

Electrical prime-movers are characterized chiefly by extremely high specific impulse, coupled with extremely low total thrust relative to their weight. This means, of course, that they can never be used as launching vehicles to establish spacecraft in orbit. But once in orbit—where the effect of gravity is small and where long operating times are acceptable—they would be extremely effective in achieving the high terminal velocities needed for long interplanetary missions.

They will produce acceleration of the order of only 0.0001 *g*, but they will do so over periods of weeks and months. A typical mission for a long-range electrical system might be to depart from an Earth orbit at an initial acceleration of 10^{-4} *g*, gradually spiral outward to Mars, descend into an orbit about Mars, and return to an Earth orbit after approximately one year at full power each way.

One small problem, of course, is that before it is possible to operate an electrical propulsion device of this kind one must have a source of electrical power. Electrical power generating devices are generally extremely heavy, and this may well outweigh advantages gained from the increased efficiency of electrical propulsion. To overcome this deficiency, solar and nuclear power sources are being developed.

The so-called Sunflower solar power supply is designed to provide a few kilowatts of power for up to a year or more, and it will be used to power the 1-kw. arc-jet. The solar energy is collected by a large parabolic mirror, and is used to operate a turbo-electric system employing mercury as a working fluid. Molten lithium hydride is used as a thermal energy storage material to provide power during periods of darkness.

The SNAP-8 nuclear system will provide 30-60 kw. by taking the heat from a small nuclear fission reactor to heat liquid sodium-potassium alloy in a primary loop. This heat is transferred through a heat exchanger to liquid mercury in a secondary loop. The mercury is boiled and the mercury vapour is expanded through a turbine which drives a generator, much as in a conventional electrical utility generation plant.

Liquid metals permit the use of high temperatures needed to

produce the electricity in a small-size lightweight plant. In SNAP-8, the goal is an engine weight of 50 lb./kw. of electrical power.

Advanced Techniques

Finally, said Gen. Ostrander, a few words might be said of a number of attractive methods of obtaining energy which are still very much in the "doubtful" stage. One cannot pretend that all, or any of them, will necessarily prove feasible, but at least they offer interesting speculations. For example, there is the possible use of such exotic fuels as rare gas ionic compounds (a typical one being argon octafluoride).

The principle consists of stripping the outermost electrons from the rare gas and surrounding the gas with a shell of fluoride ions to render it stable. The problems involved in the possible production of usable quantities of such rare gas compounds are formidable. They involve obtaining temperature gradients of 2-6 million degrees Kelvin to produce an atmosphere of rare gas ions, not to mention the development of materials and techniques capable of dealing with burning temperatures in the order of 25,000° K.

However, such compounds would store fantastic amounts of energy in the molecules themselves. Argon octafluoride, for instance, has a heat of formation of something over 12,000 kilo-calories per molecule and this would produce a specific impulse as high as 2,400 sec., compared with 500 sec. for the best chemical propellents, or about 1,000 sec. for nuclear rockets.

Another interesting concept which has not yet really undergone feasibility determination is that of the solar sail. With this device, a space "ship" may some day be able literally to sail through interplanetary space on missions permitting long travel times. The idea behind the solar sail is that it derives its propulsive power from the small but measurable radiation pressure of the Sun upon the large-area sail. The orbit of the Echo satellite was, in fact, affected very significantly by this phenomenon.

Another unique concept involves the use of the Earth's atmosphere itself as a propellent, Gen. Ostrander continued. Fantastic as it may seem, it might be possible to employ a satellite orbiting the Earth at low altitudes to collect and condense the very thin air which exists in the upper reaches of the atmosphere. (THE AEROPLANE AND ASTRONAUTICS, Nov. 11, p. 640). The collected air could then be liquefied and used as an oxidant, or it could be used as the propellent working fluid in an electrical engine.

The satellite could then act as a refuelling station for a low thrust spacecraft that would rendezvous, refuel, and continue on into space. This, of course, involves such neat tricks as reducing the size of a liquid oxygen plant, which in a ground-based version weighs thousands of tons, to a weight and size that can be carried in a space vehicle.

A somewhat similar scheme involves collecting ionized gases in space. At high orbital altitudes, we find gases such as O, highly ionized by energy from the Sun. On recombination, these ions would furnish not only a working fluid but significant amounts of energy from their recombination.

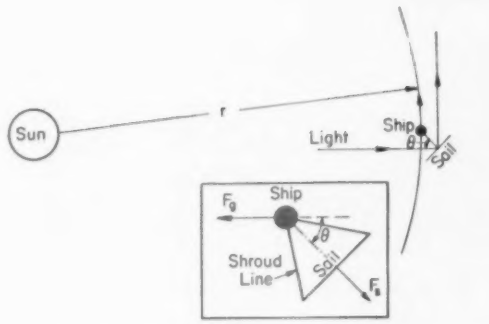


Diagram depicting the forces acting upon a solar-sail space-vehicle, Fg representing the force due to the Sun's gravitational attraction, and Fs that due to solar radiation pressure falling on the sail. In the position shown the sail would act to retard the ship's motion relative to the Sun. (From the article, "Solar Sail: Key to Interplanetary Voyaging?", by B. W. Powell, *Spaceflight*, Oct. 1959.)

Mr. Thorneycroft on Space-research

CONCERN over the length of time it is taking the Government to reach a decision regarding the use of Blue Streak in space-research was expressed during question time in the House of Commons on Nov. 7. Replying to a question by MR. WOODROW WYATT (Lab., Bosworth) on the subject of his recent talks in Australia and with the Canadian and French Governments, MR. PETER THORNEYCROFT, Minister of Aviation, said that if a heavy rocket for satellite launching were to be developed outside the United States or Russia, there "would be substantial advantages for all concerned in co-operating with our friends in the Commonwealth and Europe. The Government have been and are exploring this possibility, but I would like to carry our consultations rather further before making any statement."

Asked by MR. G. R. CHETWYND (Lab., Stockton-on-Tees) if the talks with the French had been based on Blue Streak and Black Knight, and whether the French were asked to make a financial contribution, MR. THORNEYCROFT said that the suggestion he had put to the French was that "we should have full collaboration with them both in finance and technology." It would be on the basis of work done with Blue Streak and Black Knight.

MR. G. R. STRAUSS (Lab., Vauxhall) asked if the Minister could give him any idea when the negotiations were likely to come to any finality. Would it be, "during the next few weeks or months, or is it infinite?" he inquired. "Is it to be a recurrence of the year's delay that we have already had?"

MR. THORNEYCROFT said he shared the desire to come to a conclusion, and he certainly thought we ought to make up our minds before the end of the year what the answer should be. He hoped the House would give him a little more time to finish the talks on which he was at present engaged.

Mercury Test Failure

ANOTHER setback to the Mercury man-in-space programme occurred on Nov. 8 when a production version of the one-ton capsule failed to separate as planned from a Little Joe booster launched from Wallops Island, Virginia. The intention of the exercise had been to test the escape mechanism which, by means of a pylon-mounted rocket, should have lifted the capsule clear of the booster for recovery by parachute.

What actually happened was that the escape rocket fired at a height of 35,000 ft., but for some reason the capsule and Little Joe booster remained locked together and after rising to an altitude of some 53,000 ft., plunged into the sea about 13 miles from Wallops Island.

On this occasion, instruments were the only payload, but a monkey had been a passenger in an earlier successful test. The difference, in this case, was that the capsule represented a fully developed prototype of the manned vehicle which the Americans hope to use to carry a man into space next year.

Spectrometer package developed by Bristol Aircraft, Ltd., in conjuction with University College, London, for orbiting in the first Anglo-American satellite S-51. In this form—before encapsulation in polysulphide rubber and foaming resin—the pack weighs about 310 grammes.

Aviation News in General

AUSTRALIAN BLOODHOUNDS.—Delivery of Bloodhound SAMs to Australia has begun. The first R.A.A.F. Bloodhound unit, No. 30 Squadron, will be established next January and based at Williamtown Air Station, near Newcastle, N.S.W. Work on the site has begun and will be completed in 1962.

HELICOPTER TRAINING. — The U.S. Army has on order 14 Bell HU-1A Iroquois helicopters for use as instrument trainers. They are equipped for training in blind flying and all-weather navigation.

HONEST JOHN LAUNCH.—First overland launching in Britain of an Honest John guided artillery missile was made at Larkhill on Nov. 9. It was fused to produce a simulated nuclear air-burst at a height of 500 ft. 8,000 yds. from the launch point.

"MELBOURNE" REPRIEVE.—The Australian Government has announced that the R.A.N. carrier "Melbourne" will be re-equipped in 1963 with anti-submarine helicopters if a firm price can be obtained for such a helicopter. This reverses the Government's earlier intention, announced in November, 1959, to withdraw the carrier from operational service in 1963, when her present Venoms and Gannets will be obsolete.

ILS ORDER. — Pye Telecommunications are to supply an ILS installation for the R.C.A.F. Airfield at Trenton, Ontario. This will be the first installation of the Pye system in North America.

MERCURY MALADY.—Ground crews at work on the Little Joe booster which, on Nov. 8, launched a production version of the Mercury space-capsule from Wallops Island in a test of the emergency escape system. Unfortunately, the capsule failed to separate as planned (see page 693).

SHUTTLEWORTH COLLECTION.—Rebuilt by apprentices at Gloster Aircraft Company's factory at Brockworth, this Gloster Gladiator—K-8032 — was handed over to the Shuttleworth Collection on Nov. 7. The fighter is painted in the old colours of No. 72 Squadron and its log books were presented to Air Cdre. Wheeler by Mr. H. Burroughes, the company's chairman.

XB-70 INSTRUMENTATION.—The Eclipse-Pioneer division of the Bendix Corporation has been awarded U.S.A.F. contracts for XB-70 instrumentation systems. These cover vertical-scale speed and altitude presentations and air data computers.

ASW ELECTRA.—First flight of a production Lockheed P3V-1, anti-submarine version of the Electra, will be made next March. For low-level surveillance and loiter, it will be able to operate on two engines only to increase its endurance.

MARCONI REGROUPING. — The Marconi Aeronautical Division is now being regrouped in new premises at Basildon, Essex, where the bulk of the company's aeronautical equipment is manufactured. The new extension contains laboratories and workshops for the development groups as well as commercial and administrative offices.

HELICOPTER ENGINE. — The F.A.A. has recently granted Carson Helicopters of Perkasie supplemental type certificate No. SH 1-512 authorizing the installation of the new Franklin 6VS-335 turbo supercharged 225 h.p. engine in the Bell 47G.

SOPWITH HISTORY. — Next Monday, Nov. 21, the inaugural lecture of the newly formed Historical Group of the Royal Aeronautical Society is to be given by Sir Thomas Sopwith. It is at 18.00 hrs. at the Institution of Mechanical Engineers.

U.S. HELICOPTER ORDERS. — Sikorsky Aircraft has received two contracts, totalling more than $23 million, for S-58 helicopters. One is for HUS-1s for the U.S. Marine Corps and the other is for HSS-1Ns for the U.S. Navy.

LONG-RANGE POLARIS. — The first A2 extended-range Polaris missile was successfully test-launched from Cape Canaveral on Nov. 10. It travelled some 1,600 miles, 300 miles farther than any earlier Polaris.

SKYBOLT PROGRAMME.—Douglas Aircraft Co. is using a digital computer to review the development programme for the Skybolt ALBM and to predict possible bottlenecks.

MORE PRACTICE.—Soviet scientist Prof. Sergeyev was quoted by Pravda on Nov. 10 as saying that further experience was needed in launching satellites and bringing them back to Earth before manned spaceships can be launched. "It is necessary to master in practice by repeated launchings the difficult mechanics of this undertaking," he concluded.

SPACE BLUES.—A U.S.A.F. Blue Scout, Jr., launched from Cape Canaveral on Nov. 8 suffered a second-stage failure which frustrated an attempt to send 29.4 lb. of radiation-measuring equipment to an altitude of 24,500 miles. The payload was intended to remain in space up to 10 hr.; instead, it dropped into the Atlantic.

PROJECT ADVENT. — Electronic equipment for the U.S. Army Signal Corps Project Advent, a 24-hr. synchronous equatorial orbit satellite, is to be produced by the Bendix Corp. The satellite, weighing about 1,000 lb., is designed to enter a circular orbit at an altitude of 22,300 miles. In addition, Bendix will design and build the ground terminal equipment, including two stations to be located in the vicinity of Fort Dix, N.J., and Camp Roberts, Cal. Overall cost of Advent, including launching vehicles, is estimated at $174 million.

INSIDE INFORMANT.—Lockheed Electronics Co. have developed a TV camera which allows ground engineers to view the internal workings of guided missiles during flight; later it is expected to apply the same technique to artificial satellites. The 16-mm. camera, which can be mounted inside or outside the vehicle, is about the size of a pint milk bottle.

BOOST TRANSPORT.—Lockheed's Missile and Space Division have put forward the design for a giant-size glider —wing span 211 ft.—for the purpose of moving rocket boosters of the Saturn class from factory to launching site. Glider would be towed by a large transport aircraft.

DISCOVERER AGAIN. — Another Discoverer satellite, this time with an Agena B "restartable" second stage, was sent into a polar orbit from Vandenberg A.F.B. on Nov. 12. Originally planned to eject its 300 lb. re-entry capsule after 13 circuits, its orbit was considered so successful that triggering of re-entry was being delayed until 31 orbits had been completed. Known as Discoverer XVII, the satellite is reported to embody test equipment for the Samos reconnaissance satellite programme.

Personal Flying

DESCRIBING the philosophy behind the new Piper Colt, which is the cheapest production two-seater yet built, President William T. Piper expressed the belief that it would have as much impact on present-day aviation as did the Cub, three decades ago (first flight was on Sept. 12, 1930). "Aviation," he said, "has been clamouring for a low-cost airplane, which could be used for sport and vacation flying, for the salesman who has a large territory to cover, for the flying clubs which are springing up in large numbers, and for the flying service operator.

"In recent years," he continued, "we have had to concentrate our engineering and development work on building larger, faster airplanes for corporate use such as the Aztec, Apache and Comanche. We haven't meant to slight the little fellow, and we know how much the Cub meant in getting hundreds of thousands of people in the air."

Compared with the Super Cub 150, which costs $7,880, the Colt 108 sells for $4,995 in basic form, and seems to be the nearest approach yet achieved to everyman's aeroplane. It has all the refinements of bigger aircraft, such as a steerable nose-wheel undercarriage, hydraulic brakes and a soundproofed cabin, plus a reasonable performance and a 100-lb. baggage compartment. At 1,650 lb. all-up, it can carry two people, 30 Imp. gal. of fuel, and 72 lb. of baggage, and cruise at about 110 m.p.h.

* * *

In addition to new aircraft there is a brisk demand for used American types, which are being offered here by several well-known dealers. One of these, Keegan Aviation, Ltd., of Panshanger, recently handed over what is believed to be the first Aero Commander sold by a British organization, to Mr. Emile Bustani, chairman of Contracting and Trading Company. He will use this aircraft as personal transport in the Middle East, where his British-based company is engaged in large civil contracting works.

The aircraft was handed over by Kevin C. Keegan, Sales Manager of Keegan Aviation, Ltd.

COMPACT COLT.—Cheapest two-seater yet to appear on the American lightplane scene, the new Piper Colt sells in the U.S. for just under $5,000—some $2,500 below most of its competitors. Its relationship to the more powerful Tri-Pacer is apparent in this photograph.

● Annual dinner of the A.B.A.C. is to be held at the Waldorf Hotel, London, on Wednesday, Nov. 30, at 19.30 hr. In the chair will be vice-president Sir Lionel Heald.

● With two aircraft, a Taylorcraft and an Auster IV, the Alouette Flying Club completed 164 hours during the first nine months of this year and its members have flown to Le Touquet, Brussels and Ostend. The club has raised the question of the number of hours to be flown per year to remain proficient, and suggests that 10 or possibly 20 are necessary. The Ministry, on the other hand, require only five hours in the six months before licence expiry.

● The Surrey and Kent Flying Club has increased its dual flying costs for Tiger Moths to £4 10s. an hour, from Nov. 14. It points out, however, that in the past 12 months, the solo rates on both the Chipmunk and Prentice were reduced by 10s. an hour.

Gliding Notes

by Dr. A. E. Slater

AS already reported by THE AEROPLANE AND ASTRONAUTICS, the Royal Nepalese Government has given permission again for a British soaring expedition to the Himalayas, since that proposed for last spring, which Dr. Brennig James outlined on Feb. 5, 1960, could not be organized in time. The proposed dates for next year's expedition are Apr. 23 to Jne. 3, and it is to be based on a British Mountain Soaring Trust. The party has not been made up yet, nor has its size been settled, so anyone interested is asked to apply to the Mountain Soaring Group, 27 Lennox Gardens, S.W.1.

Ernst Saxer, of Switzerland, who has flown in the region, found vertical currents, both up and down, in the most unsual places where his experience in the Alps would not have led him to expect them. The only well-equipped airfield is at Katmandu, but there is also a very primitive one at Pokhara.

* * *

A NEW side-by-side training two-seater, much more versatile than the old T-21, is being developed by Slingsby Sailplanes. Unlike the Grunau-type wings of the T-21, the wings of the new machine have a straight taper and are designed for laminar flow. Their span is 55 ft., and they have dive-brakes. The seats, seat backs and controls are adjustable, and there is an elevator trimmer.

So far, it is only called Type 49; and if, being a training machine, it is to be named after a public school, let us hope it will be one without an ambiguous spelling. The sort of training it is suited for will carry the pupil all the way from *ab initio* to cross-country and cloud flying, and it has also been cleared for aerobatics.

Meanwhile a Skylark 3 has won the Italian national contest with Ferrari as pilot, and the Skylark 3F which Philip Wills flew in the United States Championships this year, and afterwards sold to Gale Abels, was taken by Abels to the Rocky Mountains Championship, which he won not only on overall points, but on each of the three contest days.

On B.B.C. Television, from 17.30 to 18.00 hrs. on Nov. 22, a programme will be broadcast from the Slingsby works.

* * *

LONGITUDINAL stability in tailless aircraft has often been assumed to be poor owing to the short "lever arm" of the elevator control; but apparently this is not the main reason if the trouble is present at all. A discussion of the subject among experts is published in the OSTIV Section of the Swiss *Aero Revue* for November, following a description of a new tailless sailplane by S. K. Brochocki, of Montreal.

This machine, called BKB-1, with a span of 40 ft., has a sweep-back of 13° and no tapering of the wings, the aspect ratio being 10. A large vertical fin behind the central nacelle proved insufficient to prevent a yawing tendency, which strong movement of the wing-tip rudders was needed to counteract; yet the test pilot found he could side-slip easily and lost more height this way than by pushing the rudders in opposite directions to act as air brakes. Elevator control was very sensitive and landing was easy.

Apparently, the machine was not tried out in gusty weather, but Dipl.-Ing. Sandauer said that swept-wing tailless sailplanes show an exaggerated sensitivity to gusts, even weak ones. Yet straight-winged tailless machines, without sweep-back, which have an even shorter lever-arm, do not show this sensitivity, and the conclusion is that the trouble is due to the wing twisting under loads.

B. S. Shenstone, commenting on these remarks, stated that the trouble can be avoided by designing the wing so that there is no change of incidence from root to tip when the wing bends. This is done "by locating the flexural axis well aft in the wing and suitably proportioning the torsion-resisting portions." Such a wing was incorporated in the Short Sherpa by the late G. T. R. Hill.

Another participant in the discussion, Hans Zacher, summed up his ideas by saying that "the compromise between low production cost, good performance and pleasant flying qualities" is more difficult to achieve in tailless aircraft than in conventional ones. For instance, the tendency of the elevator-ailerons to act as flaps, as soon as they are moved to any degree, necessitates the centre of gravity being very closely maintained in its specified position, so that little control movement is needed.

* * *

CAMBRIDGE University Gliding Club has had a record year (they deal in "academic years" there) with 1,093 hours' flying and more Silver "C" legs, "C" certificate flights, solo conversions and conversions to the Skylark than ever before.

A notable cross-country in August was a crossing of the Thames estuary to Chatham in the club Swallow by John Row.

* * *

HANS PIETSCH, a Hanover student, has flown from the Wasserkuppe to Vienna, landing at Langenlebarn after covering 342 miles in 7 hr. 43 min.

Industry Record

Aircraft Glass Production

Extensive alterations and additions to production facilities now being undertaken at the King's Norton, Birmingham, factory of the Triplex Safety Glass Co., Ltd., will provide the company with virtually a new aircraft glass division. Almost completed, these alterations embrace a section devoted to the production and development of gold-film heated glasses.

Additions to this division, which was originally established to manufacture bullet-proof aircraft glass during the 1939-45 War, include a new vacuum vessel which is being installed to produce a layer of gold on to the glasses, and a comprehensive glass-grinding and polishing plant. With this reorganization, the company's production capacity for gold-film glasses has been doubled.

Titanium Symposium

In May of this year the Metals Division of I.C.I. held a symposium on the subject of titanium for the aircraft industry. The company has now published an illustrated record of the discussions which took place during this conference.

Some of the subjects covered include drop forging of titanium alloys, press forging of components, the machining of titanium alloys, the fabrication of aircraft and engine components in titanium sheet, and flash welding of the metal and its alloys.

Filtration Equipment

At Hove the Thermal Control Co., Ltd., is manufacturing two units for the filtration and sampling of aviation fuel, hydraulic oil, kerosene and other liquids used by the aircraft industry.

The first unit, a high-volume filter apparatus for providing laboratory methods of absolute liquid filtration of all particles of contamination larger than 450 millimicrons, is in the form of a mobile console. Designed to perform a variety of applications without modification, it can be utilized as a system filling, flushing or bleeding rig, or as a reclamation unit for dirty liquids.

At a working pressure of 100 p.s.i., the unit has a filtration volume of 90 g.p.h. It employs an automatic cut-out on the delivery pump to prevent filter membrane rupture through excessive pressure differentials, and a spring-loaded hose reel which automatically rewinds the 20-ft. of flexible hose immediately it is disconnected.

The second unit, a thermal control sampling set using Millipore field monitors, provides a method of establishing the particle contamination level of liquids in pressurized systems. In operation, the unit is connected into the system to be analysed and the operating pressure forces a representative sample through the field monitor and into a graduated polyethylene bottle.

A second bottle similarly connected enables the sampling unit to be flushed with system fluid prior to the sampling operation, so that samples from other systems may be taken without any precleaning of the unit. For analysis, the Millipore membrane is removed for microscopic counting, sizing and identification of the contaminant particles. If previously weighed the membrane may be dried and re-weighed for a gravimetrical analysis. The membrane may also be totally "ashed" to determine the organic/inorganic ratio of the contaminant.

Hydrogen Peroxide

Laporte Chemicals, Ltd., of Luton have published a data manual on hydrogen peroxide. In addition to containing physical and chemical data on this chemical, the manual also includes information on handling and storage and is intended to be of interest principally to engineers and designers in the aircraft industry.

For this reason emphasis has been given to those particular aspects of the properties of hydrogen peroxide which are especially relevant to the controlled production of instantaneous high power for aircraft assisted take-off, missiles and other applications.

Sintered Friction Materials

The Morgan Crucible Co., Ltd., and British Belting and Asbestos, Ltd., have registered a new company named Morgan-Mintex, Ltd. This new company will manufacture sintered friction materials, which will be sold under the registered trade mark Sinterlink. These materials have been developed by Morgan Crucible and are produced at their factory at Wandsworth where the new company will be located. Sales throughout the World will be handled by the Mintex Division of British Belting and Asbestos as sole concessionnaires.

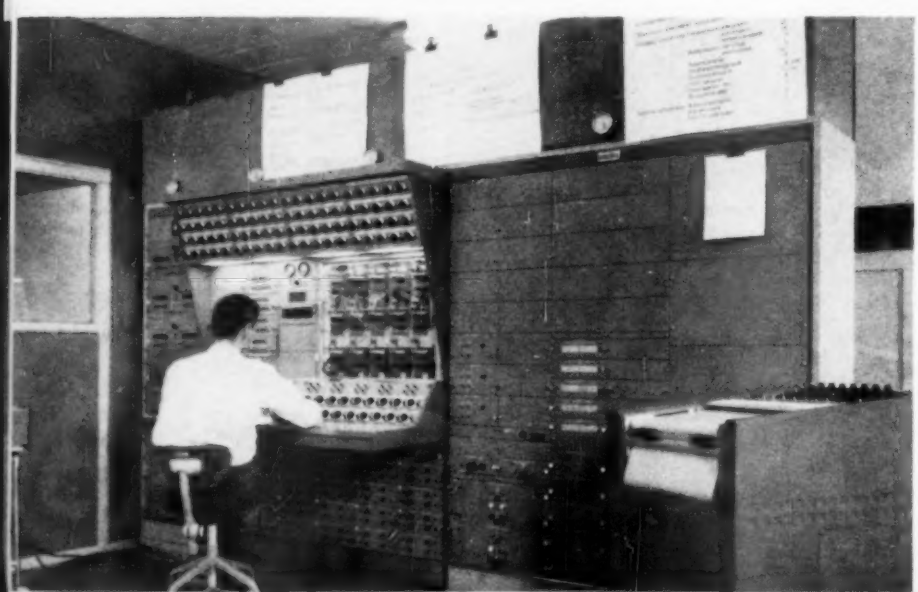
Members of the SHAPE Air Defence Technical Centre inspecting an experimental printed-circuit waveguide in the Radar Research Laboratory during their recent visit to the Borehamwood establishment of Elliott Brothers (London), Ltd.

Publications Received

Aircraft Electrical Engineering. By H. Zeffert. An important contribution to the subject, covering in great detail the principles and practices of aircraft electrics, by the chief electrical engineer of Vickers-Armstrongs (Aircraft), Ltd. 744 pp.; 5¼ in. by 8¼ in. Illustrated. George Newnes, Ltd. Price 90s.

Brassey's Annual. Edited by Rear-Admiral H. G. Thursfield. The 1960 edition of the Armed Forces Year Book including chapters on aircraft development (Rear-Admiral H. E. Heran); the aviation industry (Maior Oliver Stewart); U.S. air power (J. W. R. Taylor); air power development (D. M. Desoutter); and others of general interest. 380 pp.; 6 in. by 9¼ in. Illustrated. William Clowes and Sons, Ltd.

War in the Desert. By Glubb Pasha. A record of personal experience of the R.A.F.'s frontier campaign in Iraq from 1921 to 1930. 352 pp.; 5¾ in. by 9 in. Illustrated. Hodder and Stoughton. Price 25s.



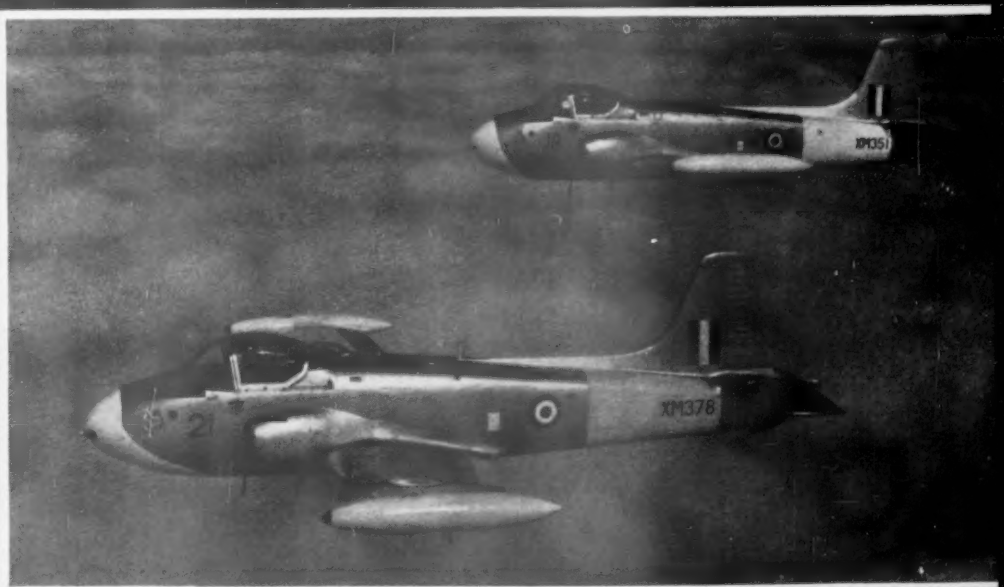
Established in November of last year, Electronic Associates Ltd., is setting up an analogue computing centre at Burgess Hill for hire to industry. The company, a subsidiary of Electronic Associates Inc., of New Jersey, which already has a computing centre in Brussels and supplied this 100 amplifier PACE 231R computer to SAAB, is also producing anglicized E.A.I. equipment for this country.

Jet Provost

Powered by one Bristol Siddeley Viper ASV 8 or ASV 11

Now in regular service at
Royal Air Force
Flying Training Schools.
Also in service with the
Royal Ceylon Air Force.

Entering service with the
Royal Air Force in 1961,
the Jet Provost T.Mk. 4
takes off in 1030 ft
lands in 1415 ft
climbs to 30,000 ft
in 13.3 minutes
has a max. level speed of
357 kt and a max.
range of 600 n.m.



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A FIELD IS A FIELD IS A...

A field down some country lane of no military significance—until a military formation asks for air defence

...GUIDED WEAPON SITE

GW.10

A battery equipped with the Thunderbird A.A. Guided Weapon arrives—it came in standard service vehicles across country—it deployed in less than an hour—the air defence has been provided • The nearby military formation moves on; so does the Thunderbird battery.

The English Electric THUNDERBIRD is:

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Correspondence

Space and the Stuff of Life

WRITING on "Questions of Space Biology" in THE AEROPLANE AND ASTRONAUTICS for Oct. 14, "A.E.S." ends his lively and well-aspected article thus: "But protein, though necessary, is not everything. The primary molecule of life is nucleic acid, the stuff of which genes are made . . . ."

Logically, then, he throws illumination in more senses than one, upon mirror-imaged sugar. And, it must be faced, sugar may well be earthbound and peculiar to the planet Earth, for it is invariably engendered with basaltic magnesium as a "hold-together." It would be extremely interesting indeed to know if sugar had been photo-synthesized with known meteorite olivine magnesium from outer space.

What is perhaps even more important, and not touched upon in the article, is that most suggestive aspect of life in which at every stage, and in every form, it filters out the ubiquitous aluminium from the very clay in which it first becomes masterly dominant. Particularly suggestive, as I say, seeing that the basic protein "template" is remarkably like that in shape and size to that of the basic aluminiumized clay "template." The very "guts" of life, it would seem, will not touch aluminium with a barge-pole!

St. Albans, Herts. L. C. WRIGHT.

[Mr. Wright's interesting suggestion, that sugar cannot be formed on a planet which lacks magnesium, is, I believe, new to the literature on the subject. So is the idea that such a planet's stock of sugar might be limited by the amount of magnesium brought in from outer space on meteorites. (Memo for sweet-toothed astronauts: bring your own magnesium.)

As to "mirror-imaged sugar," proteins likewise differ from their mirror images, and so do nucleic acids. The nucleic acid molecule has the form of a twisted ladder with an enormous number of rungs, and the twist is always right-handed.

If the advent of life on the primitive earth was inevitable or even probable, it would have started independently at many different points and there should be about as many right-handed as left-handed nucleic acids in living organisms. It looks as though the origin of life on Earth was a highly improbable event, originating in a right-handed nucleic acid molecule which became the ancestor of all the genes in every living thing on Earth.—A. E. SLATER.]

Flying on a Table

ON Nov. 1, B.B.C. Television in their "Spy-catcher" series told the story, which is supposed to be true, of a Frenchman and his chauffeur who built an aeroplane from a table and sailcloth and powered it with an engine removed from a Rolls-Royce car. With this aeroplane the two escaped from Nazi-occupied France to England.

As an engineer, I find it hard to believe that two men with no aeronautical design or engineering experience could have built such an aeroplane from "odds and ends" in five months.

I shall be interested to learn if any of your readers ever saw this aeroplane or if they can supply any information on this amazing feat of engineering ingenuity.

Personally, I find the whole story hard to believe.

Hemel Hempstead, Herts. CLIFFORD G. TONKIN.

Who for Gatwick?

WHEN will the Ministry of Aviation do the obvious and sensible thing, to direct foreign airlines, at any rate short hauls, to operate from Gatwick to relieve pressure on L.A.P.?

In France foreign lines have to operate from Le Bourget. Air France operate from Orly, their engineering base. So if Air France were the first to be directed to Gatwick they would only laugh at me. Which, says the Ed., is what I'm here for.

Groundabout

Old Hands and No Hands. The historians are reminding us that automatic flight control is nothing new. Gp. Capt. J. A. McDonald, R.A.F., says "Back in 1944 at Defford, we were able to home a Boeing 247D from 50 miles, orbit the field at a selected range, line up with the runway and land, all on the auto-approach system." And didn't a DC-4 fly from America to England and land here, about 10 years ago, untouched by human hand? We still seem a long way from everyday application. Perhaps a nice *ordinary* war would speed things up a bit.

*

It Figures. Admiral Raborn, in charge of the U.S.N.'s Polaris development, was asked whether the missile would be useful to Britain. His reply: "Polaris is like Marilyn Monroe—it does something for everybody."

*

The Low Down Under. Eddie Connellan, governing director of Connellan Airways, which contributes so much to the welfare of Australia's Northern Territory, tells me that one of his pilots, flying a Beechcraft 18 at about 10,000 ft. between Halls Creek and Wyndham, reported his position to Wyndham aeradio. They acknowledged and added "We have a police message. A utility has been stolen from Halls Creek and is thought to be on the road to Wyndham. It is a grey International, registration number HC-221." The pilot, a helpful character, replied "Say again the registration number." *Good* stuff.

*

Initial Impact. A Commander, R.N., 21 years in the Fleet Air Arm, writes to condemn the usurping of traditional initials and terms, especially, of course, "F.A.A." and "Flight Deck." Led by these headings to expect to read something about his own line of business "it is infuriating to find," he says, "that F.A.A. means some American agency that doesn't like Decca and Flight Deck refers to an air liner's front office. Please use your column to re-educate people." I'm on your side, Commander, but, you know, they'd

Mexico-operation. Among the best of the magazines this column receives is *Intercambio*, published by the British Chamber of Commerce in Mexico. In the latest lively issue, editor Pelham Wright has reprinted the *Punch* party pastime "The Export Game" and added some additional hazards for players in Mexico, hazards which, of *course*, the aircraft industry avoids:

"*Export manager on holiday*"—Go back two places.

"*Descriptive literature in English*"—Miss two turns.

"*Tender sent by seamail to 'Mexico, South America'*"—Go back four spaces.

"*Export department refuse to believe Mexicans speak Spanish*"—Give up.

The move which our enterprising industry is more likely to make is:

"*Agent's daughter marries government official*"—Advance three spaces.

*

"All I did was ask him if he'd had a nice trip."

by Lowe

Correspondence . . . .

understand. And similarly, B.E.A. have their engineering base at L.A.P. and would continue to function from there. All other foreign short haul airlines should go to Gatwick too.

I am sure their passengers would appreciate the ease of access to Gatwick, and the added comfort and safety of the train journey right to the airport building. So much better than the often delayed and sometimes hazardous coach journey to L.A.P.

Or must one of the all-too-frequent near misses become a collision with great loss of life before the M.o.A. takes notice? Let foreign airlines stand not on the order of their going but be directed to Gatwick at once. And the sooner the better. This is no time for official dallying. The move is long overdue.

Gatwick is the most modern airport in the country with the best communications.

London, W.14. GEOFFREY DORMAN.

Perpendicular Obliquity

FOR some time I have been looking for a hook on which to hang a complaint, and in your issue of Nov. 4 the article "DC-8 Confessional" (p. 617) by S.H.E. gives me just that hook.

It is appreciated that very little technical material can be written without using the particular terms peculiar to the subject discussed. This is all well and good; the reader either knows the terms or must learn their significance. BUT, there is no reason at all why the rest of the article, paper or whatever it is, should not be couched in tolerably good English.

I have taken the unfortunate S.H.E. as my cock-shy because he is guilty of so many of the pitfalls into which writers fall.

His opening paragraph, for a start, could cause offence by its contrived and prolonged metaphor and its rather strained humour. We will ignore the mixture of the confessional with bull-fighting although why a red handkerchief is tucked up the sleeve I do not know. I always thought that bulls were colour-blind and the action of waving was what caused their ire.

Then let us take a typical sentence. "Perfection may be a transcendental trait in the next world but survival and expansion are primeval to the New World." Is S.H.E. striving for immortality in a book of quotations? Again, "when the barnacles are suspended on parasitic peduncles oblique to the wing." What does that mean?

May I suggest to S.H.E. that he read some Quiller-Couch and some Elia, keep Fowler's two volumes by his bedside and, as my old English master used to say, never use three syllables where two will do and never use two where one will do. Perhaps S.H.E. who hints at so much that is sacred to some people might like to add the Authorized Version to those two volumes of Fowler.

Amlwch, Anglesey. DAI BACH.

Appreciation of Treble-one

NOW that the aerobatic team of No. 111 Squadron—The Black Arrows—has been finally disbanded, and the pilots dispersed, I feel it would be appropriate to put on record a few words of appreciation for the many really magnificent aerobatic displays by "Treble-one," both at home and abroad, which have always upheld the highest traditions of the Royal Air Force.

I must be only one of many hundreds of people who would like to express thanks and admiration to all the members of this team, both living, and to those who lost their lives in occasional tragic accidents, and to those on the ground who backed them up, for all their hard work which gave such pleasure and pride to us spectators.

It would be a very difficult task indeed to say which was the most superb demonstration ever given by the Squadron, but certainly two of the best were given at R.A.F. West Malling, in October, 1959, and August, 1960, respectively—the synchronization of the two formations at the latter being classic—both displays being given under difficulties, an M.T.C.A. height limitation of 3,000 ft. at the first and a low cloud ceiling with poor visibility due to haze at the second, but despite this each performance was faultless.

Bexhill-on-Sea. HUGH A. GORDON.

England, our England

I NOTE that a report on page 604 of THE AEROPLANE AND ASTRONAUTICS for Nov. 4 states: ". . . one particular Comet of the R.A.F. . . . is carrying the Queen of England."

Our Sovereign is "of the United Kingdom of Great Britain and Northern Ireland, Queen. . . ."

The use of the term "England" in most inappropriate contexts such as this is to be deprecated, and I am by no means the only person to deplore this inaccurate use of the word, a usage which, regrettably, appears to be increasing in certain quarters.

THE AEROPLANE AND ASTRONAUTICS is justifiably regarded as an authoritative journal. It will enhance its reputation if it chooses to employ accurate terminology in reporting the Royal Family.

Cowbridge, Glamorgan. JOHN L. S. MILES.

[Fowler says that the susceptibilities of the Scotch, Irish and Welsh in this matter are natural, but are not necessarily always to be deferred to.—ED.]

Aviation Calendar

Nov. 18

London.—The Institute of Navigation symposium held jointly with the British Interplanetary Society "Navigation for the Early Exploration of the Moon," at the Royal Geographical Society, 1 Kensington Gore, S.W.7, at 10.00 hrs.

London.—R.Ae.S. 16th British Commonwealth lecture, "The Story of Indian Air Transport," by J. R. D. Tata, at the Institution of Mechanical Engineers, 1 Birdcage Walk, S.W.1., at 18.00 hrs.

Nov. 21

London.—R.Ae.S. Historical Group lecture, "My First Ten Years in Aviation," by Sir Thomas Sopwith, at the Institution of Mechanical Engineers, 1 Birdcage Walk, S.W.1, at 18.00 hrs.

Nov. 22

Farnborough.—British Institution of Radio Engineers Southern Section lecture, "Radio Aids for Automatic Landing Developed by the Blind Landing Experimental Unit," by J. S. Shayler, at Farnborough Technical College, at 19.00 hrs.

London.—R.Ae.S. lecture, "Basic Considerations of V/STOL Aircraft," by P. L. Sutcliffe, in the Library, 4 Hamilton Place, W.1.

Nov. 23

Weybridge.—R.Ae.S. Branch lecture, "The Art of Developing Aero-engines," by A. C. Lovesey, at the Apprentice Training School, Vickers-Armstrongs (Aircraft), Ltd., at 18.00 hrs.

Glasgow.—R.Ae.S. Branch lecture by T. C. Cain, at the Engineering Building, Glasgow University, at 19.30 hrs.

London.—Kronfeld Club lecture, "The Sea and Sailing," by F. Gee and F. Irving, with slides, at the Basement, 74 Eccleston Square, S.W.1.

Cardiff.—British Institution of Radio Engineers South Wales Section lecture, "Radio Navigational Aids in Aircraft," at the Welsh College of Advanced Technology, at 18.30 hrs.

London.—R.Ae.S. Graduates' and Students' Section lecture, "The British Space Programme," by M. O. Robins, in the Library, 4 Hamilton Place, W.1, at 19.30 hrs.

Hatfield.—R.Ae.S. Branch lecture, "The Physiological Limits of Man-powered Flight," by Dr. D. R. Wilkie, in the de Havilland Restaurant, at 18.15 hrs.

Nov. 28

London.—R.Ae.S. Agricultural Aviation Group lecture, "The Farmer's Viewpoint," by J. B. Farrant, in the Library, 4 Hamilton Place, W.1, at 19.00 hrs.

Nov. 29

London Airport Central.—Institute of Transport West Middlesex Group lecture, "Airline Advertising," by A. J. Burkart, in the Conference Room, 3rd floor, Control Tower, at 18.30 hrs.

Company Notices

NEW COMPANIES

BRITAIR, LTD. (673,574).—Private co. Reg. Oct. 28. Cap. £100 in £1 shs. Construct, equip, maintain, work and let on hire, aeroplanes for the carriage of passengers or freight. Sec.: S. Hart. Reg. off.: 138-9 Bush House, Centre Block, W.C.2.

H. A. IRELAND, LTD. (670,824).—Private co. Reg. Sept. 23. Cap. £100 in £1 shs. Shipping, air transport and road transport services. Sec.: Gordon V. Graeme.

CHANGES OF NAME

Derby Aero Club, Ltd. (345,949). 78 Buckingham Gate, S.W.1.—Name changed to Midland School of Flying, Ltd., on Apr. 20, 1960.

Wolverhampton Aviation, Ltd. (369,533). 78 Buckingham Gate, S.W.1.—Name changed to London School of Flying, Ltd., on Apr. 20, 1960.

INCREASES OF CAPITAL

Airscrew Company and Jicwood, Ltd. (254,208). Weybridge Surrey.—Increased on Mar. 3, 1960, by £850,000 in 2s. ordinary shares beyond the reg. cap. of £750,000.

Sky-Rail Travel, Ltd, (648,145). 9b College Road, Harrow, Middx.—Increased on Feb. 29, 1960, by £4,900 in £1 ordinary shares, beyond the reg. cap. of £100.

New Patents

APPLICATIONS ACCEPTED

857,462.—**J. Love and D. Kay.**—"Rotary wing aircraft."—Aug. 30, 1957. (May 31, 1956.) (Cognate application 8212, May 3, 1956.)

857,037.—**Rolls-Royce, Ltd.**—"Power unit."—Jly. 9, 1959. (Sept. 27, 1958.)

857,540.—**Pye, Ltd.**—"Arrangement for the guidance control of jet-propelled missiles and aircraft."—May 10, 1957. (May 10, 1956.)

Printed specifications of the above will be available on Dec. 29, 1960, and the opposition period will expire on Mar. 29, 1961.

Personal Notices

BIRTHS

Bird.—On Oct. 31, at R.A.F. Halton Hospital, to Anne (*née* Chant), wife of Flt. Lt. Dennis L. Bird—a daughter.

Courtman-Stock.—On Nov. 2, at 3 The Avenue, Godmanchester, Huntingdon, to Alison (*née* Garrard), wife of Flt. Lt. Norman Courtman-Stock—a son.

Cox.—On Nov. 4, at P.M.R.A.F. Hospital, Halton, to Betty, wife of Flt. Lt. R. M. Cox—a son.

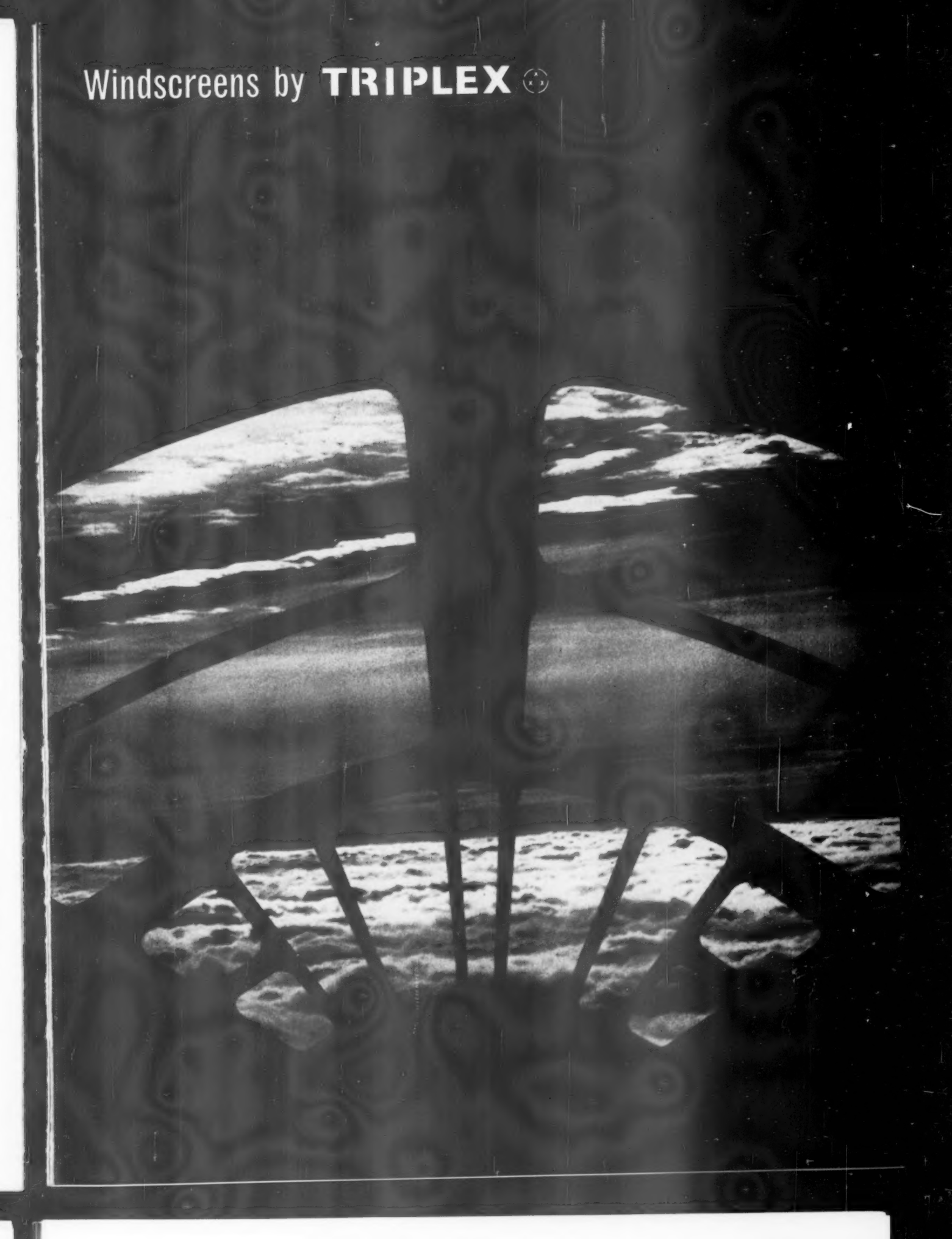
Crofts.—On Oct. 29, at Royal Hants County Hospital, Winchester, to Anne (*née* Kimpster), wife of Sqn. Ldr. W. R. Crofts—a daughter.

Matthews.—On Oct. 26, at Canberra, Australia, to Janice (*née* Read), wife of Flt. Lt. Michael Matthews—a daughter.

Miller.—On Nov. 2, at P.M.R.A.F. Hospital, Halton, to Adele (*née* Colleypriest), wife of Sqn. Ldr. J. J. Miller—a son.

DEATH

Dangerfield.—On Nov. 2, Flg. Off. Hubert A. B. Dangerfield.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We have developed these units to conform to the latest and most stringent specifications such as MIL-F-8508A, MIL-F-15618E and MIL-F-26678A for water and dirt free aviation fuels and they are tested thoroughly in the Firth Cleveland Test House to guarantee faultless performance and long trouble-free operational periods.

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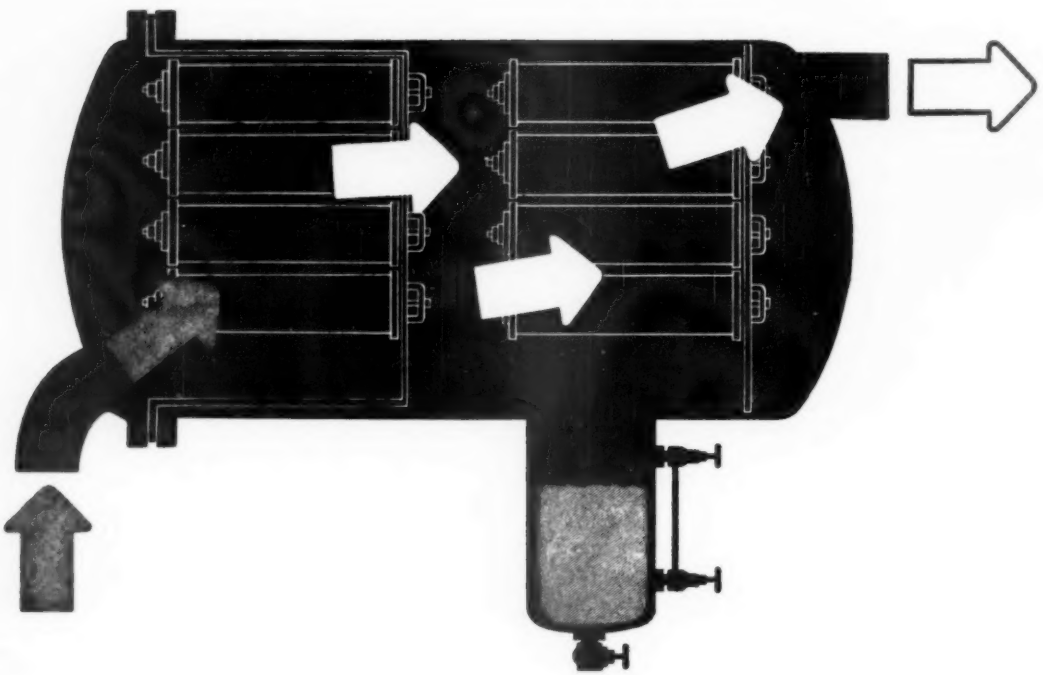
We shall be pleased to send you full information.

Fram Separator Filters have been supplied to The Ministry of Aviation, The Admiralty, The 3rd United States Air Force, all major Oil Companies and they are in service at airfield installations and refineries throughout the world.



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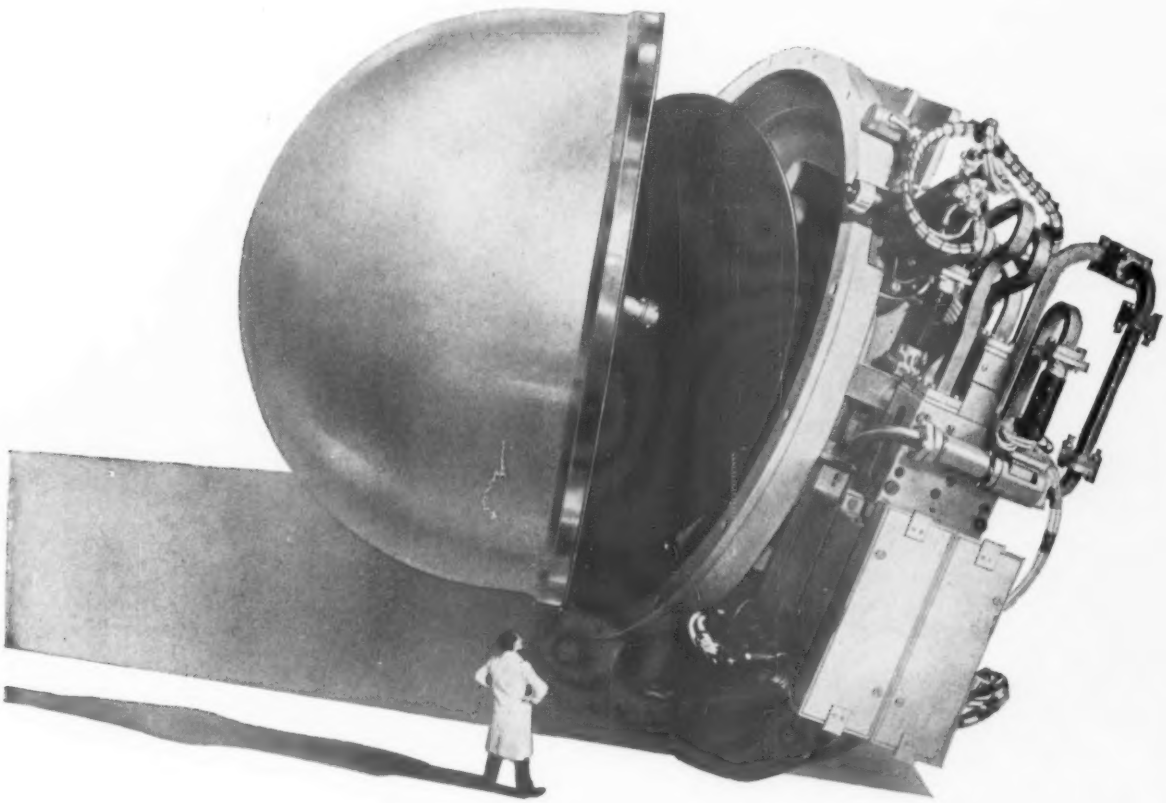

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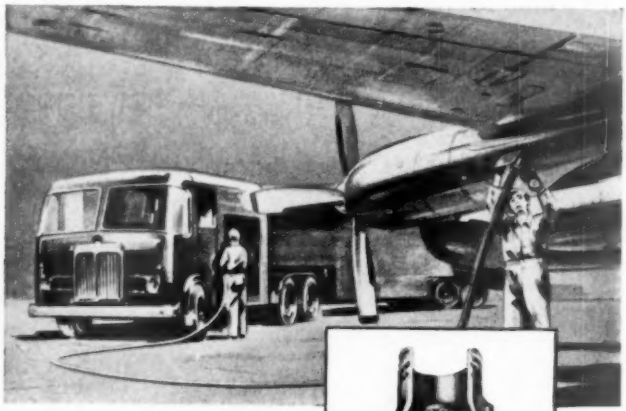

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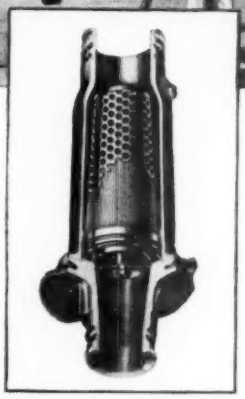

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Flying Records, Principal and World
Military Aircraft Data, British
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TEMPLE PRESS

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NOTICES

AIR TRANSPORT ADVISORY COUNCIL

THE Air Transport Advisory Council give notice that they have received the undermentioned applications to operate scheduled air services:—

FROM STARWAYS, LTD., OF LIVERPOOL AIRPORT, LIVERPOOL, 24: for the following U.K. Internal Services with Dakota and DC-4 aircraft, for the carriage of passengers, supplementary freight and mail at an initial frequency of seven return flights weekly on each service, increasing later in accordance with traffic demand, for seven years from May 1, 1961:—

APPLICATION NO. 4556 between Chester (Hawarden) and Belfast.

APPLICATION NO. 4557 between Chester (Hawarden) and the Isle of Man.

FROM BRITISH UNITED AIRWAYS, LTD., OF 35 PICCADILLY, LONDON, W.1:—

APPLICATION NO. 2573/1 for an amendment to the terms of approval of the Vehicle Ferry Service which Air Charter, Ltd., are authorized to operate with Bristol 170 and DC-4 aircraft, for the carriage of vehicles and associated passengers only, on the route Southend-Calais (opt.)-Lyons, at a frequency of three return flights daily until March 31, 1968, so as to enable Channel Air Bridge, Ltd., to operate the service and to carry supplementary freight and 25 incidental passengers daily on the route.

APPLICATION NO. 2575/1 for an amendment to the terms of approval of the Vehicle Ferry Service which Air Charter, Ltd., are authorized to operate with Bristol 170 and DC-4 aircraft, for the carriage of vehicles and associated passengers only on the route Southend-Ostend (opt.)-Dusseldorf, at a frequency of four return flights daily until March 31, 1968, so as to enable Channel Air Bridge, Ltd., to operate the service and to carry supplementary freight and 25 incidental passengers daily on the route.

FROM SILVER CITY AIRWAYS, LTD., OF 62 BROMPTON ROAD, LONDON, S.W.3:—

APPLICATION NO. 29/6 for an amendment to the terms of approval of the Normal Scheduled Service which they are authorized to operate with DH.89A, Dakota, Bristol 170, Dove, Heron and Hermes aircraft on the route Lydd or Manston-Ramsgate (opt.)-Ostend from March 1 to September 30 each year until March 31, 1967, so as to enable them to operate the service throughout the year at a frequency of seven return flights weekly during the period October to February.

APPLICATION NO. 135/5 for an amendment to the terms of approval of the U.K. Internal Service which they are authorized to operate with Dakota, Bristol 170 and Heron aircraft on the route Blackpool-Liverpool (Speke) (tech. and customs)-Guernsey (opt.)-Jersey at a frequency of eight return flights weekly on Fridays, Saturdays, Sundays or Mondays (not more than two return flights on any one day), from May 4 to September 30 each year until September 30, 1966, so as to enable them to operate from April 1 to October 31 each year and to include Wednesdays in the days of operation.

FROM B.K.S. AIR TRANSPORT, LTD., OF BERK HOUSE, BAKER STREET, LONDON, W.1:—

APPLICATION NO. 976/1 for an amendment to the terms of approval of the Normal Scheduled Service they are authorized to operate between Belfast and Dublin at a frequency in accordance with traffic demand, until January, 1964, so as to enable them to operate with Ambassador aircraft in addition to Dakota and Viking aircraft.

These applications will be considered by the Council under the Terms of Reference issued to them by the Minister of Civil Aviation on July 30, 1952. Any representations or objections with regard to these applications must be made in writing stating the reasons and must reach the Council within 14 days of the date of this advertisement, addressed to the Secretary, Air Transport Advisory Council, 3 Dean's Yard, London, S.W.1, from whom further details of the applications may be obtained. When an objection is made to an application by another air transport company on the grounds that they are applying to operate the route or part of route in question, their application, if not already submitted to the Council, should reach them within the period allowed for the making of representations or objections. 561-1

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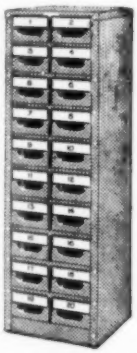

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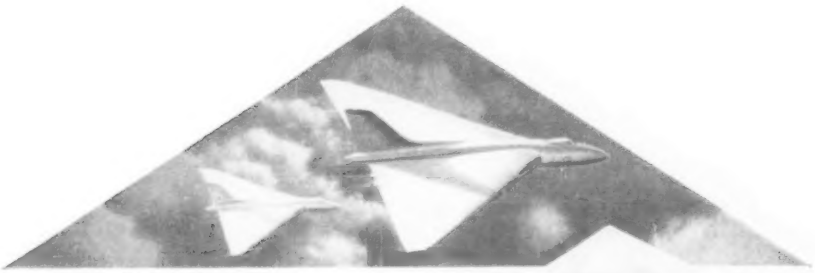

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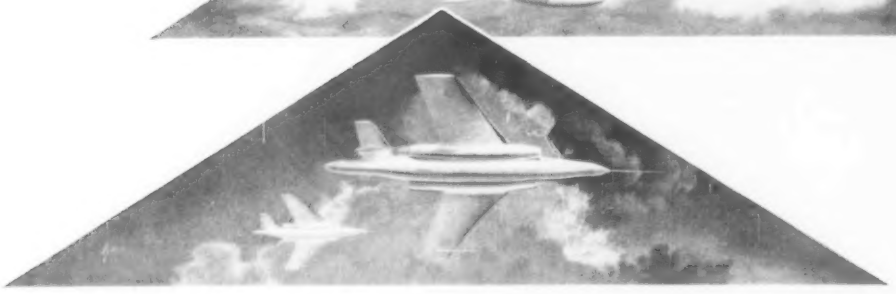

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